INSTALLATION ENVIRONMENTAL NOISE MANAGEMENT PLAN

Fort McCoy

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EXECUTIVE SUMMARY

OVERVIEW.

The Installation Environmental Noise Management Plan (IENMP) provides a strategy for noise management at Fort McCoy Elements of the IENMP include education, complaint management, noise and vibration mitigation, noise abatement procedures, and noise assessment.

The Installation Environmental Noise Management program provides a methodology for analyzing exposure to noise and safety hazards associated with military operations and provides land use guidelines for achieving compatibility between the Army and the surrounding communities. The Army has an obligation to U.S. citizens to recommend uses of land around its installations that will: (a) protect citizens from noise and other hazards; and (b) protect the public's investment in the installation.

The noise impact on the community is described by the use of noise zones. The program defines four noise zones. Zone I is compatible with most noise-sensitive land uses. Zone II is normally incompatible with noise-sensitive land uses. The Land Use Planning Zone provides the installation with a better means to predict possible complaints, and meet the public demand for a better description of what will exist during a period of increased operations. Zone III is incompatible with noise-sensitive land uses.

CONCLUSIONS.

The analysis of the noise impacts upon privately owned land around Fort McCoy shows that a few citizens are exposed to noise that exceeds the levels recommended under federal land use guidelines (FICUN 1980).

Currently, Fort McCoy and the citizens of Monroe County are in a symbiotic relationship. Fort McCoy provides jobs and protects a number of rare, threatened or endangered species. In return, a handful of people are exposed to annoying levels of noise a few times each year. The computer analysis shows that Fort McCoy's noise has not changed over the past decade. However, there are two scenarios that could shift the balance. The first would be an increased tempo of training at Fort McCoy. The second would be the development of land near the ranges and impact area in the northern third of the installation. Because of the proximity to I-94 and the Black River State Forest, the open land on the east side appears to have greater potential for construction of up-scale homes than the somewhat noisier land on the west side. Because neither scenario appears to be likely at this time, Fort McCoy and Monroe County still have an opportunity to prevent future problems through land use planning.

RECOMMENDATIONS

The following recommendations apply to Fort McCoy:

- Share the information in this INEMP with Monroe County government.
- If there is an interest, sponsor a one-day seminar to teach local officials and any interested citizens about military noise, how it is assessed and how it can be mitigated. Assistance is available from the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM) for presenting such a seminar.
- In cooperation with Monroe County officials, discuss the merits of incorporating a scenario of maximum range utilization into a county land use plan.
- Continue the current noise complaint management effort and include the noise complaint telephone number on the Fort McCoy website.
- Distribute a short and simple brochure on the Fort McCoy noise environment, to include the blast noise contour map, its interpretation, and guidelines on rattle-proofing buildings against low frequency sound. This new brochure would replace the 1996 brochure.
- Request pilots conducting flight operations in and around Fort McCoy to stay at least 400 meters away from domestic animals or protected wildlife.
- Request that pilots adhere to the Fly Neighborly guidelines.
- Choose a set of fixed flight corridors for accessing Nap of the Earth routes, provide maps of these corridors to the owners of over flown properties, and ask pilots to fly inside these corridors
- Request that the Installation Management Agency (IMA) promulgate uniform aircraft noise management guidelines for all installations.

The following recommendations apply to Monroe County:

- Determine the best way to share the information on Fort McCoy noise with people who already own noise-impacted property and people who are considering building homes on noise-impacted property.
- In cooperation with Fort McCoy officials, discuss the merits of incorporating a

scenario of maximum range utilization into a county land use plan.

There are no recommendations for Jackson County. Although a small portion of the LUPZ from the noise of large weapons does encroach into Jackson County, the area inside the LUPZ is part of Black River State Forest.

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SECTION ONE

INTRODUCTION

1.1 GENERAL.

One of the goals of the Department of the Army (DA) is to plan, initiate, and carry out actions and programs designed to minimize adverse impacts upon the quality of the human environment without impairing the Army's mission. In keeping with this goal, the Army established an Environmental Noise Management Program as the framework for the control of noise produced by Army activities. Thirty years ago, the United States Congress, as recorded in the Noise Control Act of 1972, determined that noise "presents danger to the health and welfare of this Nation's population" (PL 92-574 1972). At the same time, Congress recognized the special importance of military noise to national security and exempted the noise of combat materiel from regulation. Consequently, the only viable way to protect the general public from the adverse consequences of military noise is through noise management. The primary strategy for noise management is the Installation Environmental Noise Management Plan (IENMP) of which the Installation Compatible Use Zone (ICUZ) program is a portion

1.1.1 HISTORY OF THE NOISE CONTROVERSY.

The advent of jet aircraft in the 1950's resulted in significantly greater noise levels around commercial airports that led to an intense outcry from the public. This public outcry caused Congress to revise the Federal Aid to Airports Act to make Federal aid contingent upon implementation of programs to resolve noise problems with surrounding neighborhoods. Subsequently, Congress passed the Noise Control Act of 1972 and the Quiet Communities Act of 1978. Under these laws, airports carried out noise control measures such as: outright purchase of adjoining land; work with local communities to ensure zoning which would permit only compatible uses; development of procedures for including noise information in the consumer disclosure documents provided when real estate is sold; altering run-up procedures and locations; and, changing approach and takeoff patterns. At the present time the Federal Aviation Administration (FAA) has specific requirements for community involvement in all airport planning.

The Federal Aid to Airports Act exempted military aircraft, as did portions of the Noise Control Act of 1972. However, the Noise Control Act and the Quiet Communities Act did contain language outlining the responsibilities of Federal agencies in protecting the public from unreasonable noise impacts. Specifically these laws state that:

"Federal agencies shall, to the fullest extent consistent with their

authority under federal laws administered by them, carry out the programs within their control in such a manner as to promote an environment for all Americans free from noise that jeopardizes their health and welfare."

To comply with the intent of Congress, the Department of Defense (DOD) provided guidance to the military departments regarding the compatible use of public and private lands in the vicinity of military airfields. The DOD guidance (DOD, 1977):

- Defined restrictions on the uses and heights of natural and man made objects in the vicinity of air installations.

- Defined restrictions on land use in the vicinity of air installations to assure compatibility with the characteristics, including noise of military operations.

- Provided policy as to the extent of the U.S. Government's interest in retaining or acquiring real property to protect the operational capability of active military airfields.

As a matter of general policy, the military departments were instructed to work toward achieving compatibility between air installations and the neighboring civilian communities through a compatible land use planning and control process conducted by the local civilian community.

Based upon the DOD guidance, DA developed its Environmental Noise Management Program that considers noise from all sources of military activities, not just military airfields. The Army's program is designed to (U.S. Army 1997):

- Control environmental noise to protect the health and welfare of military personnel and their dependents, Army civilian employees, and members of the public on lands adjacent to Army, Army Reserve and Army National Guard installations.

- Reduce community annoyance from environmental noise, to the extent feasible, consistent with Army, Army Reserve and Army National Guard training and materiel testing activities.

1.1.2 THE THREAT TO MILITARY INSTALLATIONS.

It is an established fact that military installations tend to attract activity from the civilian sector. For example, sizeable new communities may grow up near an installation or existing communities may expand toward or around an installation's boundaries. This growth process can place severe limitations upon the ability of a military installation to support training and for assigned units to maintain an adequate level of readiness. Herein lies the threat: as noise impacts from military activities increase upon the civilian communities, both litigation and/or political pressures which could result in degradation of the installation's mission also increase. Not only does the number of complaints to installation commanders increase dramatically, but so does the number of complaints to members of Congress.

As the consequence of adverse public reaction to military operations, some military installations have closed and others have had limitations placed upon the conduct of operations.

One of the best examples of the degradation of mission performance due to encroachment occurred at the Naval Air Station (NAS), Los Alamitos, CA. When originally established during World War II, this NAS was in a rural area. With the postwar expansion of southern California, Los Alamitos NAS was eventually surrounded with homes and the Navy could no longer routinely fly jet aircraft into this property. Table 1.1, reproduced from the decision paper on transferring Los Alamitos Airfield to the Army (Project Wire, 1971) shows the growth in population leading up to the Navy's decision to discontinue flight operations.

Table 1.1 Orange County Population Growth (in Thousands): 1920 -1969.

1920	1930	1940	1950	1960	1065	1960
61.4	118.7	130.8	216.2	719.5	1,135.7	1,379.3

Today, Los Alamitos Army Airfield serves the needs of the California Army National Guard (ARNG) and the U.S. Army Reserve, which compared to the Navy, operates relatively few noisy flights. Loss of capability from population expansion in California has not, however, been limited to the Navy. As noted by the UC Berkeley Center for Environmental Design Research and Institute for Urban and Regional Development. "*California is home to sixty-four military installations, more than any other state. All four major military service branches plus the Coast Guard operate facilities in California. More than half of California's military installations are located within, at the edge of, or within a*

stone's throw of major metropolitan areas. California is also home to more than 34 million people, most of whom also live in metropolitan areas. By 2020, the California Department of Finance projects California's population will grow to 45 million. Much of this growth will occur at the edges of existing metropolitan areas, nearby or adjacent to active military installations. Without some degree of forward planning to reconcile the space needs of California's growing population with the operational needs of the military, the encroachment of urban growth on California military installations may significantly compromise the presence, functions and missions of the military in California."

1.1.3 CONTENDING WITH THE THREAT.

The consequences of ignoring the conflicts between noises generated on military installations and the desires of the civilian community regarding use of the land surrounding these installations can be grave. If the military fails to respond to the concerns of the civilian community, the ill will produced by such an approach is quite likely to result in unwillingness within the civilian community to work with the military to regulate land use. The community ill will can also result in political pressure or lawsuits that force unilateral concessions on the part of the military without any reciprocal concessions from the community.

In order to prevent the conflicts between military operations and civilian land use from reaching significant proportions, it is necessary for the Army to work with the local communities to prevent incompatible land use from occurring and to take reasonable steps on the installation to protect the community from noise. Since the regulation of land use on adjoining land is the authority of local communities, the military cannot solve these problems unilaterally. Rather, the military must work with local communities to establish the controls that will prevent noise problems from growing even larger.

1.1.4 ARMY'S INSTALLATION ENVIRONMENTAL NOISE MANAGEMENT PLAN.

The primary strategies for protecting the mission of military installations from the problems of noise incompatibility are long-range land use planning and being a responsible neighbor to its surrounding communities. The Installation Environmental Noise Management Plan (IENMP) addresses these issues in a proactive manner.

The Installation Compatible Use Zone (ICUZ) program is an element of the IENMP. This element assesses the compatibility of the noise environment with the land uses.

The other elements of the IENMP, including education of both the military and civilian community about noise assessment procedures, management of noise complaints, mitigation of the noise and vibration, the "Fly Neighborly" program and noise abatement procedures are aimed at being a responsible neighbor to the communities surrounding Fort McCoy.

1.1.5 STAGES OF THE INSTALLATION ENVIRONMENTAL NOISE MANAGEMENT PLAN PROCESS.

Stage 1: Quantify the installation's noise environment

The primary means of assessing environmental noise is through computer simulations. Computer generated noise contours can be shown on installation land use maps to be incorporated into the installation master plan and National Environmental Policy Act (Public Law 91-190 1970) documentation. A more detailed discussion of noise modeling is provided at Appendix A.

Stage 2: Identify noise-impacted areas

During this stage noise contours are overlaid on maps to determine areas that are currently or potentially impacted by installation noise-producing activities.

Stage 3: Identify existing and potential incompatible land uses

Using the noise contour overlays, current and future land uses are examined to identify those land areas that are or will be incompatible. This stage requires coordination between the installation and the civilian communities.

Stage 4: Identify alternative actions to mitigate/minimize noise impacts.

The purpose of this stage is to generate a wide range of alternative actions that could be taken by either the installation or the community to minimize noise impacts. Like stage 3, this also requires coordination between the installation and the civilian communities.

Stage 5: Evaluate alternative actions.

During this stage the impact of the various alternatives identified must be evaluated.

Stage 6: Develop agreements with local communities and agencies.

At this stage good-faith efforts will be made to negotiate agreements with local communities and agencies that affect or will be affected by the commitments made as a result of the IENMP.

Stage 7: Submit agreements for review by decision-makers.

The installation commander and the elected bodies or decision-makers within the affected civilian communities must ratify all agreements.

Stage 8: Publish final IENMP and implement agreements.

The final IENMP must be made available to the public and contain all elements of the process, including agreement reached. It is at this stage that agreements should begin to be implemented. Expectations regarding timing and sequencing of implementing actions should be defined, so that disagreements do not arise.

Stage 9: Update and review.

Procedures should be established to monitor the agreements and to determine effectiveness of actions taken. Agreements, like physical facilities, need occasional maintenance. Established procedures for monitoring the agreement are essential to ensure that problems are identified and solved in a cooperative manner. This stage is essential to examine the impact of changes in Army training doctrine and modern weapons technology.

1.2 PURPOSE.

The purpose of the Fort McCoy IENMP is to assess the noise environment and provide a plan to manage this environment through land use planning and being a responsible neighbor.

1.3 OBJECTIVES.

The objectives of the IENMP are:

- Education of the military and civilian communities about noise assessment and

improved communications between the two.

- Management of noise complaints to reduce the potential for conflict between Fort McCoy and the surrounding communities.

- Assessment of the compatibility of the noise environment with the existing and proposed land uses.

- Mitigation of the noise and vibration environments, where feasible, to increase land use compatibility.

- Use of noise abatement procedures.

1.4 CONTENT.

The body of the report consists of a discussion and analysis of Fort McCoy and the surrounding communities and the relationships between them. The report presents the Installation Environmental Noise Management Plan concept, policies and methodologies. The report analyzes the effect of Fort McCoy noise, describes the responsibilities of the Army and the communities, and provides recommendations for both the Army and the communities.

SECTION TWO

FORT MCCOY & THE COMMUNITY

2.1 GENERAL.

This section examines the relationships between Fort McCoy and the surrounding civilian communities in terms of the histories, populations, activities and needs of what are, in reality, parts of an integrated system rather than separate, independent entities. Since there are few areas in which Fort McCoy and the community does not depend upon each other, it is important to understand the nature of the mutual interests and concerns which form the basis for both present and future civilian and military cooperative efforts.

2.2 FORT MCCOY.

2.2.1 PHYSICAL DESCRIPTION.

Fort McCoy comprises 60,000 acres with land-use permits for access to approximately 60,000 additional acres. The physical plant consists of 1,140 barracks, administrative, dining, and maintenance facilities. More than 40,000 (66 percent) of Fort McCoy's 60,000 acres are forestlands. Approximately 40 percent of the forested land (32 percent of Fort McCoy's total land area) is commercially valuable. All forest acreage is tracked using computer programs to enhance multiple-use, sustained-yield forest management. From 4,000 to 5,000 acres are reinventoried each year.

The post's forest inventory currently consists of approximately 12,200 acres (25 percent) of jack, red and white pine; 21,800 acres (46 percent) of low-value scrub oak; 3,500 acres (7 percent) of commercially valuable red, black and white oak; and 3,500 acres (7 percent) of mixed hardwoods, which include soft maple, aspen, white birch and elm.

2.2.2 FORT MCCOY HISTORY.

The following history has been reproduced verbatim from the Fort McCoy web site: http://.McCoy.army.mil.

Fort McCoy is named for Robert Bruce McCoy. The son of a Civil War captain, McCoy was a prominent local resident who, throughout his lifetime, served as a lawyer, district attorney, county judge and mayor of Sparta, Wis. He reached the rank of major general during his 31 years of distinguished military service, which

included service in the Spanish-American War, the police action in Mexico, and World War I.

McCoy returned from the Spanish-American War with a dream. He knew that as warfare became increasingly more modern, larger and more-powerful guns would be developed, and training would be emphasized. He envisioned these changes would require larger training areas, and, by 1905, he had acquired approximately 4,000 acres of land in the Sparta area.

Maj. Samuel Allen of the 7th Field Artillery at Fort Snelling, Minn., also admired the terrain of the Sparta area for its training value. September 1905 marked the first use of the land for military purposes. McCoy invited Allen's unit to put his family's ranch to the test during 16 days of training.

As a result of the 16-day test, Allen recommended to an Army review board that a large piece of land be purchased for an artillery camp. Approximately 14,200 acres of land, including McCoy's 4,000 acres, were purchased in 1909. The resulting parcel was called the "Sparta Maneuver Tract."

The Sparta Maneuver Tract was divided approximately in half by the Chicago, Milwaukee, St. Paul and Pacific Railroad. The maneuver camp situated on the northern half of the parcel was referred to as Camp Emory Upton, while that to the south was known as Camp Robinson

In 1910, the War Department authorized $40,000 for construction and improvements to the area. Within that same year, the reservation was renamed Camp Bruce E. McCoy, in honor of the Civil War captain and former owner of the maneuver camp lands. The camp retained that name until Nov. 19, 1926, when it officially was designated as Camp McCoy in honor of Maj. Gen. Robert B. McCoy, who had died that same year.

Nearly 9,500 acres of land were acquired from the Department of Agriculture in 1938-39. From 1940-1942, an additional 37,437 acres were acquired by a directive from the Secretary of War. These additions included construction of the large, triangular-shaped cantonment area, much of which still exists today.

The "New Camp" officially was inaugurated Aug. 30, 1942. Total cost for the construction was estimated at $30 million, and the camp capacity was set at 35,000. Camp McCoy was used as a training facility for many World War II units, including the 2nd Infantry Division, the 76th Infantry Division and the 100th Infantry Battalion, which was comprised of Hawaiian National Guardsmen of Japanese ancestry. The post also served as a prisoner-of-war and enemy-alien

prison camp during this time.

Aside from temporary lulls, the installation has been in almost constant use since its founding in 1909 and has provided artillery and maneuver training opportunities for hundreds of thousands of military personnel from all services.

Camp McCoy was aligned under U.S. Army Forces Command July 1, 1973, and officially was redesignated as Fort McCoy Sept. 30, 1974.

Today, Fort McCoy's primary mission is providing for the training and ensuring the readiness of America's reserve- and active-component armed forces. The post also is one of 15 Army power-projection platforms. In 1990-91, during Operations Desert Shield/Storm, more than 9,000 soldiers from 74 separate units and their equipment were deployed and redeployed at Fort McCoy.

From June 1991 through June 1992, the post also completed one of the largest reserve-component equipment demobilization/repair missions in the Army – Operation Desert Fix. During Desert Fix, Fort McCoy was responsible for inventorying, inspecting, repairing and returning more than a division-and-a-half's worth of equipment to 121 owning units located throughout a nine-state area.

Training levels at Fort McCoy reached record proportions in fiscal year 2000, with 149,432 personnel participating. The installation has trained more than 100,000 personnel annually for nearly two decades.

Fort McCoy was aligned under the U.S. Army Reserve Command (USARC) in 1993. As part of this realignment, Fort McCoy serves in a "parent installation" role for two direct-reporting installations – Fort Hunter Liggett and Parks Reserve Forces Training Area, which both are located in California.

It should also be noted that under a reorganization of 1 October 2002, the responsibility for Fort Hunter Liggett and Parks Reserve Forces Training Area is expected to pass to the USA Installation Management Southwest Region, which is located in San Antonio, Texas, and the *responsibility* for Fort McCoy is expected to pass to the USA Installation Management Northwest Region, which is located in Rock Island, Illinois. As of the publication of the current IENMP in April 2003, this change had not taken place.

2.2.3 FORT MCCOY MISSION.

To enhance readiness by:

- Supporting Training
- Serving as a Power-Projection Platform
- Providing Installation Management Expertise
- Providing Selected Services On and Off Post

Fort McCoy is the only U.S. Army installation in Wisconsin, as well as the only Army facility in the upper Midwest that is capable of providing the full spectrum of individual and collective training for combat, combat service and combat service support personnel.

The installation serves as a Total Force Warfighting Training Center that annually supports the year-round training of active and reserve component U.S. military personnel from all branches of the armed services. 145,437 personnel trained at Fort McCoy in FY 01. Training is conducted throughout the year by all branches of the service, active and reserve component. Of the 145,437 personnel training at McCoy in FY 2001, 40,249 participated in two-week annual training (AT) and 105,188 participated in weekend or multiple unit training assembly (MUTA) training. A total of 26,243 civilian personnel are included in the training totals, including 1,286 for AT, who were on post for two weeks or more, and 24,957 for weekend training, who were on post for a weekend or less. These include police departments, schools, and Boy Scouts.

2.2.4 FORT MCCOY TRAINING.

Training Requirements

Fort McCoy's primary product/service is to ensure active- and reserve-component military customers receive the highest-quality training facilities and training opportunities that contribute directly to their abilities to maintain a high state of readiness.

Fort McCoy's products and services include providing maneuver space, ranges and facilities. The installation serves the U.S. Army as a world-class, ever-ready Power-Projection Platform that is capable of providing pre-mobilization training resources for the deployment and redeployment of the reserve components of America's Army. Fort McCoy provides the infrastructure, facilities and services necessary to sustain combat-ready reserve-component forces. Installation-management and quality-of-life programs are provided to enhance the living and working environments of the employees, customers and suppliers within our geographical support area.

Fort McCoy also provides a variety of services to Department of Defense and non-DoD agencies on a regional, national and international level.

Aircraft Training

Fort McCoy controls the airspace in two restricted areas, Restricted Area R6901A includes all air space over the installation north of Highway 21, and Restricted Area R6901B includes all air space over the installation south of Highway 21. Among the activities supported are:

- Passenger/VIP/Delivery/Shuttle
- MEDEVAC training
- Short takeoffs and landing on the Young Assault Strip
- Nap of the Earth (NOE) training
- Close Air Support of Army ground units by the Air Force
- Fixed-wing aerial gunnery[1]
- Rotary-wing aerial gunnery[2]

To support this training, Fort McCoy operates a joint use airfield with the town of Sparta. McCoy Army Airfield (AAF) has two (2) runways:

(1) Runway 01-19, overall 2825 feet x 100 feet with an overrun area of 1375 feet x 50 feet.

(2) Runway 11-29, overall 4700 feet x 100 feet.

There are 15 aircraft based at this field. Eleven of these are single engine airplanes, one is a multi engine airplane and three are military aircraft. Operations average 39/day with 70% military, 15% transient general aviation and 14% local general aviation.[3] Most military flights are internal to Fort McCoy.

Training Areas

State Highway 21 divides Fort McCoy just south of the cantonment area. The

[1] Ordnance permitted for fixed-wing gunnery: 2.75-inch FEAR WP and Lead Head, BDU-33, 20/20 mm rounds, flaraes from SUU-25 dispensers, and 500 lb MK-82 inert bombs. An "inert bomb" has the same look and weight as a real bomb, but is filled with concrete. It does not explode upon impact.

[2] Authorized ammunition for rotary wing aerial gunnery is limited to 7.62 mm, .50 cal, 40 mm TP, 20 mm, 30 mm, TOW inert and 2.75-inch Rockets: M274, M257 with MK66 rocket motor.

[3] http://www.airnav.com/airpor/KCMY

area south of Highway 21 contains training areas A-1 through A-6 and B-1 through B-33. South Post also contains McCoy AAF and the Badger Drop Zone for parachute training. North Post contains training areas C-1 through C-21, D-1 through D-12, and M-1 through M-7. Although virtually all of Fort McCoy is divided into training areas, not all training areas are open for use at any one time. As stated in Paragraph 13-3 of the Range Regulation (Ft McCoy, 2000), Range Operations operates a Land Rehabilitation and Maintenance Plan (LRAM). Portions of training areas are set aside for restoration by the Integrated Training Area Management (ITAM) coordinator at Range Operations. LRAM areas are off limits to all general training activities until full recover of the site has been determined. LRAM areas are delineated with signs, tape and a map overlay. An area designated as LRAM can still be used for the firing of artillery, air drops of troops and equipment, and for passage of military vehicles. However, vehicles are required to remain on recognized tank trails.

When using an unrestricted training area, commanders must still consider environmental concerns. Maneuver and training plans must include provisions for protection of known sensitive areas, and for maneuver and training damage repair (i.e. clearing concertina, filling ditches and foxholes, rut repair, trash removal). Such care limits the extent of LRAM areas.

The system for tracking LRAM areas evolved out of research funded by the Department of Defense's Strategic Environmental Research and Development Program (SERDP) and conducted by the Department of Energy's Argonne National Laboratory and US Army Construction Engineering Research Laboratories (USACERL) The central component is a vegetation (land cover) change model, which incorporates naturally occurring changes, changes due to training use, and those resulting from resource management activities.
In addition to tracking the state of vegetation in the training areas, Range Operations restricts access to archeological/historical resources and areas where there are endangered species. The Karner blue butterfly, a federal endangered species, is found a nine (9) designated sites that are off-limits to all vehicle maneuvers and digging. The perimeter of each area is marked with diamond-shaped yellow signs. Because of the outstanding efforts with LRAM and the protection of the Karner butterfly, Fort McCoy's Biological and Cultural

Resources Management Team was awarded top honors in the FY99 Secretary of the Army Environmental Awards competition. Other species of concern are the Blanding's turtle and 14 species of rare native plants.

Training Ranges

The primary training ranges are shown in Figure 2.1. All of the ranges at Fort McCoy make some amount of noise, but very few ranges generate enough noise to be annoying to even the closest neighbors. The quietest ranges support small arms training or training with subcaliber substitutes of larger, noisier weapons. As a general rule, people living farther than 500 meters from the firing line of an "unbaffled" small arms range will not be disturbed by the noise. The term, "unbaffled" refers to the absence of any housing or vertical surfaces capable of reflecting gun sounds to locations in back of the firing line. Because noise levels directly in front of a rifle are about 12 decibels higher than directly behind a rifle, baffles can cause noise problems. For example, introduction of baffles in a range operated by the Delaware Army National Guard raised levels to the rear by 8 decibels, resulting in complaints by residents living 500 meters behind the range (US Army, 1987a). None of Fort McCoy ranges are baffled, so the 500 meter rule applies. Table 2.1 lists Fort McCoy's small arms/subcaliber ranges and their locations. Table 2.2 lists the noisier ranges $_{in}$ addition to the fixed ranges, there are surveyed mortar and firing points throughout the installation. Their locations are shown in Figure 2.2.

2.2.5 INSTALLATION COMMAND.

Fort McCoy operates like a small town. It has its own police force, Post Exchange, commissary, restaurants, gas station, child development center, recreational facilities, fitness center, motel and resident housing..

2.2.6 TENANT ORGANIZATION AND ACTIVITIES.

In addition to offices directly under the commander of Fort McCoy, there are tenant organizations serving important roles for Fort McCoy and military activities in nearby states. Here is a list of the tenants:

- The 10^{th} Ordnance Battalion, 84^{th} Division (Institutional Training) (10^{th}/84^{th} BN (OD)) provides Maintenance and Ammunition training for personnel in the U.S. Army Reserve (USAR) and Army National Guard (ARNG) throughout a six-state area.

Figure 2.1 Locations of the more important ranges at Fort McCoy

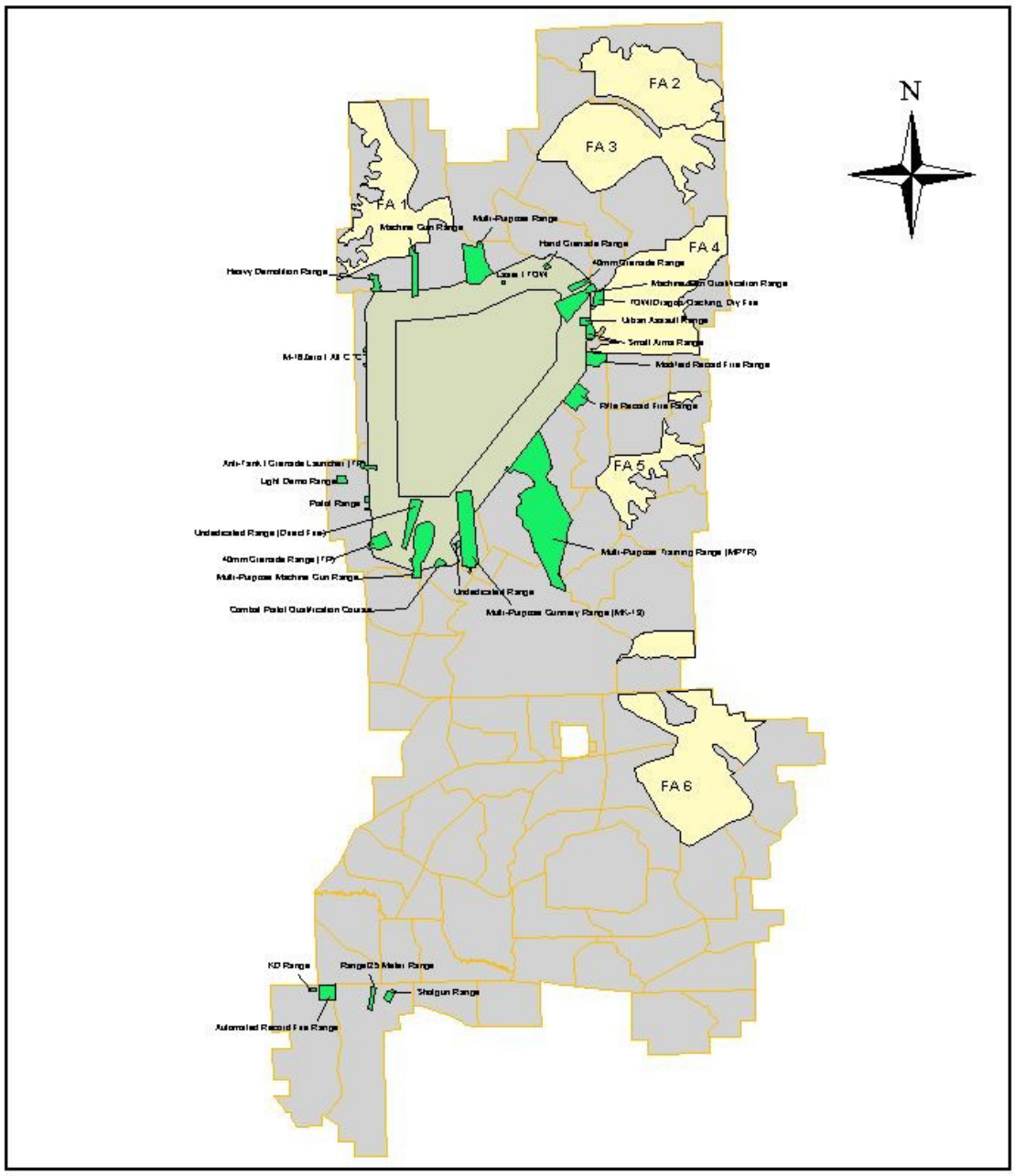


Table 2.1. Small Arms/Subcaliber Ranges at Fort McCoy.

SITE	LOCATION	TYPE SITE	AMMUNITION
RG1	XJ835786	Combat Pistol Qualification	.22,.38,.40,.45,9 mm, 10 mm, shotgun
RG2	XJ830786	Multi-purpose Machine Gun	5.56, 7.62 mm. .50 cal, all small arms
RG6	XJ845866	Multi-purpose	.22, .38, .40, shotgun, 5.56, 7.62, AT-4 subcal,40 mm TP. IL, SMK
RG7	XH820793	M203 Qualification & Familiarization	40 mm TP
RG12	XJ816811	Anti-armor, M203 Familiarization	LAW, DRAGON, SMAW& AT4 sub-cal, 40 mm TP, IL,
RG18	XJ830866	MG & SAW familiarization	5.56 mm, 7.62 mm, .50 cal
RG26	XJ847789	MICLIC, Mortar subcal	MICLIC inert, Mortar subcal
RG31	XJ873828	Rifle Qualification	.22, .38, .49, .45, 9mm, 10mm, shotgun, 5.56
RG32	XH877828	Modified Rifle Record Fire	.22, .38, .40, .45, 9mm, 10 mm, 5.56 mm
RG33	XJ872845	25 meter multi-purpose	22, .38, .40, .45, 9mm, 10 mm, shotgun, 5.56
RG34	XH875856	MG Transition & SAW familiarization	5.56 mm, 7.62 mm, .50 cal
RG36	XJ878855	TOW & DRAGON Tracking	ATWESS Cartridges
RG100	XJ819678	25 meter multi-purpose	.22, .38, .40, shotgun, 5.56 mm
RG101	XJ808678	Automated rifle record fire, known distance	.22, .38, .40, .45, 9mm, 10mm, shotgun, 5.56
RG102	XJ804678	25 meter multi-purpose	22, .38, .40, .45, 9mm, 10mm, shotgun
RG105	XJ825675	Skeet Rahge for Ft McCoy Rod and Gun Club	shotgun

Figure 2.2 Location of Artillery and Mortar Firing POints at Fort McCoy

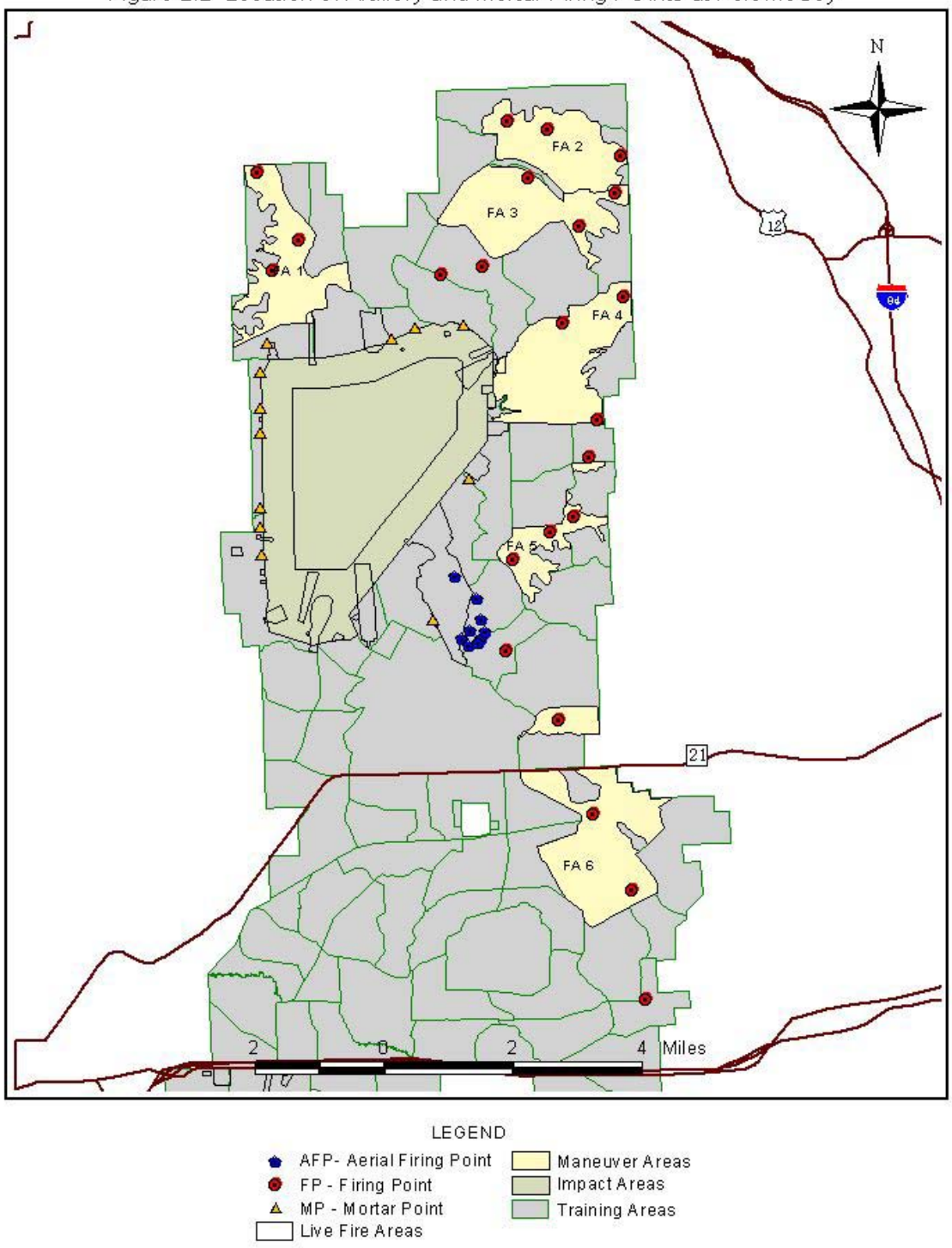


Table 2.2. List of the Noisier Ranges at Fort McCoy.

SITE	LOCATION	TYPE SITE	AMMUNITION
RG4	XJ825788	Artillery Direct Lay, Copperhead Firing	105 mm, 155 mm HE Copperhead
RG8	XJ861863	Hand Grenade Live Throw, Fragmentation, Concussion	Hand Grenade, including smoke
RG11	XJ812807	Light Demolitions, MDI transition	C4, TNT, Dynamite, Det Cord
RG13CL	XJ852858	TOW Live fire, Mortar Direct Fire	TOW inert, 60 mm, 81 mm, 120 mm HE
RG15	XJ	Light Demolitions, MDI transition	C4, TNT, Dynamite, Det Cord
RG17A	XJ820856	Heavy Demolitions	C4, TNT, Dynamite, Det Cord, Bangalore, shaped, cratering
RG29	XJ866782	Tank & Aerial Gunnery, strafing, TOW	5.56, 7.62, .50 cal., all mortar IL,20,25,30,40, 105, 120 mm
RG29A	XJ854809	Anti-armor, M203, MK19 familiarization	DRAGON, 40 mm, SMAW, LAW, AT4
RG35	XJ874859	M203 familiarization	40 mm HE grenades

- The 2nd Brigade, 85th Division (TS) provides branch, functional, special training assistance and conducts Training Assessment Module (TAM) and Lane Evaluations for U.S. Army Reserve and National Guard commands and units to attain and/or sustain individual and unit readiness. Supported units are in Wisconsin, Minnesota, and Illinois.

- 14 BN/84th Regiment.

- The mission of the 6015th Garrison Support Unit (GSU) is to conduct premobilization training, participate in mobilization exercises, augment the Fort McCoy staff during mobilization, provide command and control for mobilizing units and personnel, conduct strategic mobility operations, and process mobilized units, personnel and equipment for deployment and redeployment. The main body is in Forest Park, IL with one detachment at Fort McCoy and another in Hurley, WI.

- The 788th Ordnance Company (Explosive Ordnance Disposal) provides routine and emergency EOD support to military installations, operations and exercises. Support is provided to civilian, state and federal authorities within a six-state area of operations, which includes North Dakota, South Dakota, Minnesota, Iowa, Wisconsin, and Illinois, for a total of about 298,000 square miles.

- The Army and Air Force Exchange Service (AAFES) mission is to provide quality merchandise and services of necessity and convenience to authorized patrons at uniformly low prices. The Fort McCoy AAFES supports nine other exchanges in Wisconsin, Minnesota and Illinois.

- The primary mission of the Army Reserve Readiness Training Center is to design, develop, and implement U.S. Army Reserve pre-mobilization and functional training for the full spectrum of military and civilian members of the Armed Forces (U.S. Army Reserve (USAR) Full-Time Support (FTS) military and civilian personnel, selected Troop Program Unit members, as well as active-component soldiers in support of the USAR). Additionally, the ARRTC provides specialized training and performs technical support missions.

- B Co, 2/228th Aviation supports the aviation needs of Fort McCoy.

- Defense Commissary Agency provides groceries and other supplies.

- The Defense Military Pay Office is responsible for providing timely and accurate pay and permanent change of station travel support to the active-component and Active Guard/Reserve military personnel assigned to units at Fort McCoy and throughout the upper Midwest.

- The Defense Reutilization and Marketing Office (DRMO) Sparta is the Defense Logistics Agency representative and technical authority regarding disposal matters within its assigned geographical area of responsibility. The DRMO Sparta area of responsibility includes portions of Wisconsin, Minnesota and Iowa.

- Equipment Concentration Site (ECS) 67 receives, stores, maintains and issues U.S. Army Reserve equipment that either is considered beyond the owning units' capability to store and maintain at their home Reserve Centers or is not considered necessary for the unit to conduct inactive duty training.

- Medical Support Activities, to include the Troop Medical Clinic, provide first line medical services to troops, military families and the civilian work force.

- The Maneuver and Training Equipment Site (MATES) is a maintenance facility owned and operated by the State of Wisconsin and the Wisconsin Army National Guard. The equipment located at MATES is used by all branches of the military service for training throughout the year. The primary mission of MATES is to receive, store and maintain equipment at one location so all units will have the best equipment with which to train.

- The mission of the Naval Mobile Construction Battalion 25-Seabees (NMCB-25) is to provide and maintain a trained, ready and immediately available organized reserve-component force capable of responding to the requirements of the Naval Construction Force, Third Naval Construction Brigade and the Ninth Naval Construction Regiment, as may be tasked in the event of war, national emergency, or when otherwise authorized.

- The Reserve Training Site Maintenance (RTS-MAINT at Fort McCoy provides hands-on maintenance training for personnel in the U.S. Army, U.S. Army Reserve, Army National Guard and Department of the Army civilian work force.

- A primary responsibility of the RTS-MED is providing military medical personnel with training and training support. RTS-MED also assists evaluators of training, provides medical maintenance training support and tests and evaluates new equipment produced at government research and development labs. RTS-MED at Fort McCoy primarily supports soldiers from Wisconsin, Iowa, Ohio, Indiana, Michigan, Illinois, Minnesota, North Dakota, Nebraska, Colorado, West Virginia, Missouri, Kansas, Massachusetts and New York.

- USAR NCO Academy – Fort McCoy trains Non-Commissioned Officers.

- The mission of the Wisconsin Military Academy and the 426th Regiment (Leadership) is to provide a professional learning environment, quality instruction and training support for the military and public-service community Together, these units support the Wisconsin Officer Candidate School and field artillery training.

- B Company 6th BN 52nd Aviation Regiment provides aviation support.

- Defense Automated Printing Service prints documents needed by Fort McCoy and the Reserve Command.

- The Wisconsin State Patrol Academy exists to provide the public-service community with quality training and training support in a professional learning environment. Access to a large variety of small arms ranges is an important reason for locating the Academy at Fort McCoy.

2.3 THE CIVILIAN COMMUNITY.

Fort McCoy is located in Monroe County with the northern boundary touching on Jackson County. Monroe County includes covers 901 square miles. The two cities are Sparta (population of 8,648 in 2000 census) and Tomah (population of 8,419).

2.3.1 POPULATION.

According to the 2000 census, Monroe County had a population of 40,899, which equates to about 45 persons per square mile. Entering this value into an equation originally published by the USEPA and reconfirmed by Stewart et al. (1999) yields an expected average day-night sound level (DNL) of 38.9 decibels (dB).[4]

This is a fairly quiet environment, and it is reasonable to expect the population to be more reactive to noise than a typical suburban populations, where the expected DNL is 55 dB.

The citizens of Monroe County tend to be homeowners, with 73.7% ownership rate compared to 68.4% for the State of Wisconsin and 66.2% for the United States. At the same time, the rural nature of Monroe County results in lower property values, with the median value of owner-occupied housing units being $77,500 compared with $112,200 for Wisconsin and $119,600 for the United States. One of the reasons for the lower median value is the lower cost of rural land. In addition, a lot of people are living in well-insulated, one story houses without large windows. Because large, multi-story wooden buildings with large picture windows are particularly prone to the induction of vibrations from the low frequency sound energy of large guns, the more modest accommodations of people living near the northern flanks of Fort McCoy may be advantageous.

[4] The USEPA's equation is DNL = 10 * log (population per square mile) + 22. This equation predicts that the DNL in a wilderness area with no human population would be 22 dB. This is a realistic value for the volcanic crater of Hawaii's Haleakala National Park or a desert where there are no trees and few birds.

Typically, rural areas have a lower percentage of college graduates than suburban areas. In Monroe County, 13.2% of persons age 25 or greater compared with 22.% in Wisconsin and 24.4% nationally. Thus, the average person in Monroe County is expected to be less tolerant of some of the more "ivory tower" language used by environmental noise experts. It will be important to communicate the findings of the IENMP in clear, plain language.

Employment

County wide, the workforce is heavily skewed toward white collar occupations. The 2000 census data on workforce composition is reproduced in Table 2.3. For a rural area, relatively few people, 2.1%, work in farming, fishing and forestry occupations. Immediately north of Fort McCoy in Jackson County, the percentage is 4%.

Table 2.3. Distribution of Occupations in Monroe County.

OCCUPATION	Percent
Management, professional and related occupations	27.2
Service occupations	16.9
Sales and office occupations	21.2
Farming, fishing and forestry occupations	2.1
Construction, extraction, and maintenance occupations	9.4
Production, transportation, and material moving occupations	23.3

Employment profiles for Tomah and Sparta are somewhat different. According to the Sparta website http://www.spartawisconsin.org/demographics.html, Fort McCoy is the leading employer in the city. The list of top employers is reproduced in Table 2.4.

In Tomah, 24% of the workforce is employed by Federal, State or local government, but Tomah is less dependent on Fort McCoy than Sparta. The top employer in Tomah is the VA Hospital with about 725 employees. Tied for second place is the Walmart Distribution Center and Toro Company, each with about 650 employees. Major employers in the industrial parks is listed in Table 2.5. Tomah's location -- midway between Minneapolis and Milwaukee, and where the state's interstate system divides -- provides for a prosperous industrial development environment.

Table 2.4. Sparta's Leading Employers.

Employer	Employees	Nature Of Business
Fort McCoy	2,090	Military Base
Northern Engraving	1,079	Metal Nameplate
Monroe County	490	Varied
Sparta School District	395	Public Education
Franciscan Skemp Healthcare	185 - Total 154 - Hospital 31 - Clinic	Health Care
CFI of Wisconsin. Inc.	175	Dairy Industry
Morrow Memorial Home	175	Nursing Home
Spartek	170	Metal Finishing
Sparta Manufacturing	155	Foundry
Carlisle Brush Co.	145	Assorted Brushes
Wal-Mart	137	Retail
Mathews, Inc.	93	Archery

Table 2.5. Major Employers In Tomah's Industrial Parks.

Manufacturing	Description	# Employees
Toro Company	Lawn equipment	650
Cardinal IG	Glass manufacturers	350
Cardinal TG	Glass manufacturers	172
International Paper	Injection molding	250
Band Box Cleaners	Laundromats & Drycleaning	140
Meca Sportswear	Sports clothing	40
USEMCO	Lift station/water pumper stations controls systems & tanks	120
Trucking Terminals	**Telephone**	**# of Trucks**
Conway Central Express	608-372-7388	70
USF Holland	608-372-7800	70
Martin Trucking	608-372-7070	130
Keene's Transfer	608-372-4178	40
Tomah Transit	608-372-0855	19
Quast Transfer	608-374-4901	39
Wal-Mart Distribution Center	608-374-8500	400
Non-Manufacturing	**Description**	**# Employees**
Department of Veterans Affairs	Medical care	725
Tomah Area School District	Educational	435
Tomah Memorial Hospital	Medical care	207

Income

According to the Sparta website, Monroe County has a labor force of 19,900 workers with an unemployment rate of 3.1%. The average weekly manufacturing wage in the county is $490.00, significantly lower than the state-wide average.

The average weekly wage for all industries in the county is $440.00, compared to

state-wide average of $526.00. According to Census Bureau data, the median household income for 1999 was $37,170 in Monroe County compared with $43,791 for Wisconsin and $41,994 for the USA.

2.3.2 ECONOMIC IMPACT.

Table 2.6. summarizes the economic impact of Fort McCoy for Fiscal Year 2002.

Table 2.6. Fort McCoy's Economic Impact.

Fort McCoy Facts & Figures 2002

(Source: Fiscal Year 2002 Economic Resource Impact Statement)

Employment: 1,620 civilians; 398 military; 242 contract.

Size: 60,000 acres, with land-use permits for access to approximately 60,000 additional acres.

Buildings: 1,140 barracks, administrative, dining, and maintenance facilities.

Work Force Payroll: $81.2 million.

Other Operating Costs: $73.9 million.

Estimated Economic Impact: $357.75 million.

Contracts: $42.6 million.

New Construction: FY 1980 - FY 2002 $154 million.

Revenues to Local Governments: $332,361.

Military Retirees: 356,871 retirees are serviced by Fort McCoy.

Training Population: 138,203 personnel trained at Fort McCoy in FY 2002. Training is conducted throughout the year by all branches of the service, active and reserve component. Of the 138,203 personnel training 36,926 participated in two-week annual training (AT) and 101,277 participated in weekend or multiple unit training assembly (MUTA) training.

2.3.3 INSTALLATION-CIVILIAN COMMUNITY RELATIONSHIPS.

Fort McCoy is located approximately seven miles west of Tomah, six miles east

of Sparta, 25 miles south of Black River Falls, and 35 miles east of La Crosse. Each of these communities is home to a variety of industries and offers many recreational and social opportunities and events. The installation enjoys positive working relationships with, and public support from, the chambers of commerce, county and school boards, civic organizations, veterans groups and the general citizenry within these communities.

2.3.4 RECREATION.

Fort McCoy provides hunting and fishing opportunities for military, military retirees and the general public. Hunting permits are issued for small game, waterfowl, fall turkey, deer (both gun and archery), spring turkey and trapping.

A Fort McCoy Fishing Permit and a State of Wisconsin Fishing License are required of all who fish on Fort McCoy. All persons possessing a valid Wisconsin Fishing, Sportsman's, or Conservation Patron's License will be eligible to purchase a Fort McCoy Fishing Permit, except individuals who have received a letter as a result of a Fort McCoy violation which restricts or prohibits their fishing privileges for its said period of time.

Fort McCoy maintains portions of the Black (Robinson Creek), La Crosse, and Wisconsin (Lemonweir River) River basins. The Black and La Crosse Basins comprise almost all of McCoy's 60,000 acres. The watersheds drain in a westerly direction off the installation, eventually emptying into the Mississippi River. The two basins include 11 installation lakes and impoundments, totaling 184 surface acres, which provide habitat for warm- and cold-water fish species. Fort McCoy has approximately 71.2 miles of cold-water streams and tributaries. The majority of the lotic ecosystems are Class I trout waters, which maintain naturally reproducing brook and brown trout. The Fort McCoy Fisheries Program manages for healthy and viable aquatic resources. Table 2.7 lists the fishes found on Fort McCoy.

Table 2.7. Species of Fish Found in Fort McCoy Streams and Lakes.

Family Species Name	Common Name
Catostomidae	• Catostomus commersoni -- White sucker
Centrarchidae	• Lepomis cyanellus -- Green sunfish
	• Lepomis gibbosus -- Pumpkinseed
	• Lepomis gulosus -- Warmouth
	• Lepomis macrochirus -- Bluegill
	• Micropterus salmoides -- Largemouth bass
	• Pomoxis nigromaculatus -- Black crappie
Cottidae	• Cottus bairdi -- Mottled sculpin
Cyprinidae	• Notemigonus crysoliucas -- Golden shiner
	• Notropis cornvus -- Common shiner
	• Pimephales notatus -- Bluntnose minnow
	• Pimephales promelas -- Fathead minnow
	• Rhinichthys atratulus -- Blacknose dace
	• Semotilus atromaculatus -- Creek chub
Esocidae	• Esoclucius -- Northern pike
Gasterosteidae	• Culaea inconstans -- Brook stickleback
Ictaluridae	• Ictalurus melas -- Black bullhead

Percidae	• Ictalurus natalis -- Yellow bullhead • Ictalurus nebulosus -- Brown bullhead • Icatlurus punctatus -- Channel catfish • Etheostoma exile -- Iowa darter • Etheostoma nigrum -- Johnny darter • Perca flaverscens -- Yellow perch • Percina maculata -- Blackside darter
Petromyzontidae	• Lampetra appendix -- American brook lamprey
Salmonidae	• Salmo gairdneri -- Rainbow trout • Salmo trutta -- Brown trout • Savelinus fontinalis -- Brook trout
Umbridae	• Umbra limi -- Central mudminnow

2.4 SUMMARY.

Since the establishment of Fort McCoy, annual expenditures directly by the federal government and indirectly by the military personnel assigned to Fort McCoy and the civilians employed by Fort McCoy have contributed to the local economy and provided substantial employment in the surrounding communities. Similarly, Fort McCoy benefits from the surrounding communities. Thus, each community, military and civilian, is mutually dependent upon the other. The Fort McCoy Installation Environmental Noise Management Plan has been developed for the specific purpose of aiding military and civilian officials and planners in the creation of land use plans and policies that promote compatibility between the needs of the civilian sector and Fort McCoy's mission requirements. The concept, program and methodology behind the Army's program that provides for reports of this nature are discussed in the sections that follow.

SECTION THREE

FEDERAL, STATE AND LOCAL LAND USE POLICY AND CONTROL

3.1 FEDERAL.

The only direct land use controls available to the federal government in Wisconsin result from fee-owned land and easements related to federal projects.

3.2 STATE.

Under the provisions of Chapter 16.023 of the Wisconsin Statutes, the legislature has encouraged state-wide land use planning through the establishment of the Wisconsin land council. The functions of the land council are listed below:

16.023 Wisconsin land council.

(1) The Wisconsin land council shall conduct the following functions:

(a) Identify state land use goals and recommend these goals to the governor.

(b) Identify state land use priorities to further the state's land use goals and recommend to the governor legislation to implement these priorities.

(c) Study areas of cooperation and coordination in the state's land use statutes and recommend to the governor legislation to harmonize these statutes to further the state's land use goals.

(d) Study areas of the state's land use statutes that conflict with each other and recommend to the governor legislation to resolve these conflicts to further the state's land use goals.

(e) Identify areas of the state's land use statutes that conflict with county or municipal land use ordinances, and areas of county or municipal land use ordinances that conflict with each other, and recommend to the governor legislation to resolve these conflicts.

(f) Establish a technical working group that is composed of the state cartographer, a representative of the University of Wisconsin System who has expertise in land use issues and any other land use experts designated by the council's chairperson, to study the

development of a computer-based Wisconsin land information system and recommend to the governor legislation to implement such a computer system.

(g) Establish a state agency resource working group that is composed of representatives of the departments of administration, agriculture, trade and consumer protection, commerce, natural resources, revenue, transportation and other appropriate agencies to discuss, analyze and address land use issues and related policy issues, including the following:

1. Gathering information about the land use plans of state agencies.

2. Establishing procedures for the distribution of the information gathered under subd 1 to other state agencies, local units of government and private persons.

3. The creation of a system to facilitate, and to provide training and technical assistance for the development of, local intergovernmental land use planning.

(h) Study the activities of local units of government in the land use area to determine how these activities impact on state land use goals, and recommend to the governor legislation that fosters coordination between local land use activities and state land use goals.

(i) Identify procedures for facilitating local land use planning efforts, including training and technical assistance for local units of government, and recommend to the governor legislation to implement such procedures.

(j) Gather and analyze information about the land use activities in this state of the federal government and American Indian governments and inform the governor of the impact of these activities on state land use goals.

(k) Study any other issues that are reasonably related to the state's land use goals, including methods for alternative dispute resolution for disputes involving land use issues, and recommend to the governor legislation in the areas studied by the council that would further the state's land use goals.

(L) Gather information about land use issues, at its discretion, in any reasonable way, including the following:

1. Establishing a state-local government-private sector working group to study and advise the council on land use issues.

2. Holding public hearings or information meetings on land use issues.

3. Conducting surveys on land use issues.

4. Consulting with any person who is interested in land use issues.

(m) Enter into a memorandum of understanding with the land information board to ensure cooperation between the council and the board and to avoid duplication of activities.

The legislature has also enabled every level of local government to engage in land use planning. Of particular relevance to the unincorporated area around Fort McCoy is Chapter 59, Counties, Subchapter VII, Land Use, Information and Regulations, Environmental Protection Surveys, Planning and Zoning. In Chapter 59.69 (3), the legislature authorized County Development Plans. The extent of a county's power has been defined in 59.69 (4) where the legislature states the purpose to be the promotion of "public health, safety and general welfare."[5] In 59.69(4)(b), the legislature includes "areas in which residential uses may be regulated or prohibited."

The legislature has also required sellers to disclose defects in residential properties to the buyers. As explained in Appendix B, the current disclosure form is not an effective means for informing buyers about undesirable noise exposures.

3.3 LOCAL.

Monroe County is a member of the Mississippi River Regional Planning Commission. The Mississippi River Regional Planning Commission – MRRPC is a Commission of nine counties (Buffalo, Crawford, Jackson, LaCrosse, Monroe, Pepin, Pierce, Tremealeau, and Vernon) located along the Mississippi River in Western Wisconsin. The Commission was organized in 1964 to provide planning assistance on regional issues, assist local interests in responding to state and federal programs, provide advisory service on regional planning problems, act as a coordinating agency for programs and activities, and provide cost shared planning and development assistance to local government.

Specific examples of services include: comprehensive community plans, zoning and subdivision ordinances, grant writing, geographic information system map production, revolving loan fund administration, economic development planning, economic data collection and dissemination and public advocacy on issues affecting the region. Commission activities are directed by a Board of 27 Commissioners appointed by the

[5] Although 59.69 (4) does not mention noise, it is reasonable to include protection from noise as promoting public health, safety and welfare, since the USEPA's 1974 report on environmental noise regulation was titled, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.

County Boards and Governor. Each County is represented by three commissioners.

Monroe County does not restrict residential development based on noise. Nor is there a provision for regulating residential construction to reduce noise impact.

3.4 OTHER DOD PLANNING TOOLS.

Historically, the Department of Defense has encouraged communities in the vicinity of military installations to introduce noise planning, first through the Air Installation Compatible Use Zone (AICUZ) program and, within the Army, through the Installation Compatible Use Zone (ICUZ). To assist communities in planning, the AICUZ, ICUZ and IENMP reports have generally included a land-use compatibility table developed by U.S. Federal agencies. This table has been omitted from the current IENMP, since Table 3.1 takes precedence.

A third planning tool is the Joint Land Use Study (JLUS). The JLUS study empowers local planning officials to obtain an independent evaluation of an AICUZ, ICUZ or IENMP along with a systematic approach to protecting the citizenry from military noise.

The JLUS program is managed by the Department of Defense Office of Economic Adjustment (OEA)(DoDD 3030.1). OEA may provide technical and financial grant assistance directly to state or local governments to help local jurisdictions understand and development controls to resolve perceived community - land development incompatibilities and make informed land use and development decisions. The scope of the program is divided into three major tasks:

- Impact analysis to provide an in-depth review of existing and proposed land development patterns, transportation and utility improvements, installation mission activities (particularly noise; existing and proposed routes; and noise/vibration as presented in the IENMP Study) and identifies encroachment issues.

- Land development and mission compatibility strategy that uses the above findings to identify conflicts in development patterns and provides alleviation alternatives (measures that can be taken by the base and area jurisdictions to protect the public health, safety and welfare and ensure a sustainable installation mission).

- The JLUS report makes specific implementation recommendations for the base and each jurisdiction. It must be kept in mind that each participating government must decide which recommendations will be implemented. Recommendations to the installation similarly are implemented at the discretion of the installation commander.

An AICUZ, ICUZ or IENMP is a prerequisite for a JLUS study but not an automatic

gateway to a JLUS study. The OEA will only fund a JLUS study if both the community and the military installation jointly request a JLUS study.

3.5 ARMY POLICY AND ITS APPLICATION AT FORT MCCOY.

It is Army policy to manage lands, facilities and resources under its control in a manner that provides maximum mission effectiveness while recognizing the importance of the conservation of resources and preservation of the quality of human and natural environments. The Army developed the IENMP and the ICUZ program to provide a mechanism for identifying and addressing issues and concerns between the community and the installation.

3.6 LAND USE PLANNING DETERMINANTS.

Compliance with the laws, regulations, executive orders, and guidelines, which are applicable to current operations and to restoration of sites contaminated by previous activities is fundamental to attaining DA goals associated with environmental protection and conservation of natural resources. In this respect, DA has designated the achievement of the following goals, applicable in land use planning, as an integral part of the overall Army mission.

- Demonstrate leadership in environmental protection and improvement.
- Minimize adverse environmental and health impacts while maximizing readiness and strategic preparedness.
- Assure that consideration of the environment is an integral part of Army decision-making.
- Initiate aggressive action to comply with all applicable federal, state, regional, and local environmental quality laws.
- Restore lands and waters damaged through past waste disposal activities.

To achieve the foregoing DA goals, the policy at Fort McCoy, which applies to all subordinate organizations, agencies and activities, is to:

- Comply with Army Regulation 200-1, and all applicable federal, state, and local environmental quality laws, regulations, and other requirements.
- Plan, initiate, and carry out all actions and programs in a manner that will preserve,

protect, restore, or mitigate the degradation of human and natural environments.

- Ensure historic, archeological, and cultural sites, structures, and other objects under Fort McCoy jurisdiction will be preserved, restored, and maintained for the benefit of future generations.

- Eliminate or control environmental degradation resulting from training, operations, maintenance, repair, or construction of real property facilities.

3.7 LAND USE COMPATIBILITY.

With an overview of Fort McCoy's land, airspace and facility requirements, the rationale behind the Army's efforts, through the Installation Environmental Noise Management Plan and the ICUZ program, to achieve compatibility between military operations and private property interests should be more apparent. The successful accomplishment of the Army Reserve training missions depends upon the positive involvement of local government in all elements of the IENMP, including land use planning and control, if needed.

3.8 ENVIRONMENTAL JUSTICE.

Environmental Justice (EJ) is defined by the U.S. Environmental Protection Agency as "fair treatment of people of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies." Over the last decade, attention to the impact of environmental pollution on particular segments of our society has been growing. Concern that minority populations and/or low-income populations bear a disproportionate amount of adverse health and environmental effects, led President Clinton to issue Executive Order 12898 in 1994, focusing federal agency attention on these issues. To this end, Fort McCoy will insure that the EJ philosophy is embraced in the management of noise from its activities. The location and use of training activities, such as firing ranges, is always based on the operational, safety and environmental considerations of both the installation and civilian community.

3.9 SUMMARY.

The purpose of this section was to examine the federal, state and local land use policies and controls. Compared with some other military installations within the United States, Fort McCoy is in a favorable position, because the Wisconsin legislature has passed legislation to enable counties, such as Monroe County, to regulate residential development for the purpose of protecting public health, safety and general welfare. The next section of this report lays out the case for land use management around Fort McCoy, to include a description of the degree to which military training noise has an adverse

impact in land adjacent to aircraft corridors and firing ranges.

SECTION FOUR

THE INSTALLATION ENVIRONMENTAL NOISE MANAGEMENT PLAN

4.1 INTRODUCTION.

In the past, the emphasis of the Army's Environmental Noise Program has been the Installation Compatible Use Zone (ICUZ) program. The goal of the ICUZ program is to maintain land use compatibility with the installation's noise environment. At many installations, the land uses around the facility already are not compatible with the noise environment.

To reduce the potential for conflict between the installation and surrounding communities, the Army developed the Installation Environmental Noise Management Plan. In addition to the ICUZ, the plan includes education of both installation personnel and surrounding residents, management of noise complaints, mitigation of the noise and vibration, and noise abatement procedures. At installations with noise monitoring capabilities, monitoring system and data management are also included in the plan.

4.2 EDUCATION/AWARENESS.

An important element of the Installation Environmental Noise Management Plan is education. This includes the education of both the noise producers and the noise receivers. The noise producers must be aware of all Fort McCoy policies and regulations dealing with environmental noise. These include the locations of no-fly areas, noise-sensitive areas, and range safety procedures. The education of the noise producers will include the potential for adverse consequences to Fort McCoy's ability to perform and maintain its mission due to violations of the policies and regulations.

The noise receivers will be made aware of Fort McCoy's mission and its by-products, including noise, through newspaper articles, community displays, public presentations, and other information released to the community. These information releases will address the concerns of the community.

Local government officials, including the zoning and planning boards, must also be informed so that they will be able to accurately assess both sides of issues before them.

4.3 NOISE COMPLAINT MANAGEMENT.

The purpose of the Noise Complaint Management Program is to educate first time complainers so that they are aware that Fort McCoy cares about their concerns. In most cases, the courteous and honest treatment of the complainant will reduce the potential for future calls; letters to local, state and federal government officials; and formation of community action groups.

There are two key words to a successful complaint management program. They are ***integrity*** and ***sensitivity***.

The program must have integrity so that when installation officials tell the community something, the community will believe and trust them. Once told, the community considers the information as installation policy. If it becomes necessary to change back to a noisy procedure, then the installation should explain the reasons for the change before the change takes place.

A successful noise complaint management procedure will assist the installation in avoiding community action against its activities. Like the other elements of the Installation Environmental Noise Management Plan, this procedure will be proactive. Its purposes are to reduce the potential of noise complaints by keeping the public informed about what is going to happen and to satisfy the complainants so that noise complaints do not escalate into political actions.

The potential of noise complaints can be reduced by providing the news media with press releases when unusual operations are scheduled or when normal operations are scheduled to resume after a period of inactivity. The press release should include a telephone number that the community can use to receive additional information or complain about the noise. Also, the news media should be monitored to make sure the information is being released to the community in a timely manner.

A noise complaint procedure is required by Army Regulation (AR) 200-1 (U.S. Army 1997) to log and investigate all complaints.

Fort McCoy first published its noise complaint procedures in A Citizens Guide, Volume 1, Issue 1, September 1996. Those procedures are repeated below:

1. Citizens should call 388-4848 (Range Operations) as soon as an incident occurs and identify the type of problem, location and time of occurrence.

2. All calls are logged-in and investigated without delay to determine responsibility (Fort McCoy, Air Force, Air National Guard, etc.)

3. Complaints are routed to the office responsible for the type of activity that resulted in the noise complaint, i.e. the airfield or Range Operations at Fort McCoy, Volk Field or other appropriate training activity.

4. The Public Affairs Office requires a response from the responsible activity for the purpose of providing information to the complainant. Every effort will be made to correct the situation, mission permitting.

5. If a citizen believes they have a valid claim against the government for property damage, they should call the Legal Office at Fort McCoy, 388-2165/2237.

4.4 INSTALLATION COMPATIBLE USE ZONE (ICUZ) PROGRAM.

The Army ICUZ program provides a method for evaluating the effect of noise and the hazards associated with training operations that stem from activities at military installations. The purpose of the program is to identify land areas that are exposed to generally unacceptable noise levels and aircraft accident potential and to then recommend uses for the land lying within these areas that are compatible with the needs of the civilian community and the Army. The primary tools for identifying land where planning is needed are the ***noise zone map*** and the ***safety zone map***.

The ICUZ program considers the land areas, with noise-sensitive land uses, that are exposed to generally unacceptable noise levels and aircraft accident potential. There are three noise zones. Noise Zones III (NZ III), II (NZ II) and I (NZ I) are projected using computer models (For detailed information see Appendix A). Noise-sensitive land uses include, but are not limited to, residences, schools, medical facilities, and churches. At military airfields supporting a substantive volume of fixed wing military aircraft, the safety zones are divided into the Clear Zone, Accident Potential Zone I and Accident Potential Zone II. Because Fort McCoy's airfield does not have a high volume of fixed wing aircraft, further discussion of the aircraft safety zones has been omitted.

4.4.1 NOISE ZONES.

DESCRIPTION

- **NOISE ZONE III.** NZ III consists of the area around the source of the noise in which the day-night sound level (DNL) is greater than 75 decibels, A-weighted (dBA) for aircraft, vehicle, and small arms range noise, and greater than 70 decibels, C-weighted (dBC) for noise from weapon systems larger than 20-mm. The noise level within NZ III is considered so severe that noise-sensitive land uses should not be considered therein.

- **NOISE ZONE II.** NZ II consists of an area where the day-night sound level is between 65 and 75 dBA or between 62 and 70 dBC. Exposure to noise within this area is considered significant and use of land within NZ II should normally be limited to activities such as industrial, manufacturing, transportation and resource production. However, if the community determines that land in NZ II areas must be used for residential purposes, then noise level reduction (NLR) features should be incorporated into the design and construction of the buildings. A discussion of NLR features is included in Appendix A.

- **NOISE ZONE I.** NZ I include all areas around a noise source in which the day-night sound level is less than 65 dBA or less than 62 dBC. This area is usually suitable for all types of land use activities.

The extent of the noise emanating from Army weapons firing, aircraft and other military activities at specific sites will be depicted graphically further on in this section. Note: During the examination of the environmental noise attributable to Fort McCoy operations, DNL will always refer to the C-weighted DNL (CDNL) to describe large caliber weapon firing or blast noise and to A-weighted DNL (ADNL) to describe small arms weapons firing, aircraft, vehicle, etc. A more detailed description of the noise environment and the methodology used in noise evaluation is provided at Appendix A.

4.4.2 ACCIDENT POTENTIAL ZONES FOR AIRCRAFT.

Since the bulk of military flight operations out of McCoy Army Airfield, there is no need to discuss accident potential zones for fixed wing aircraft. Most of the military flights are rotary wing. For the record, Army policy defines two safety zones for heliports (U.S. Army 1978, 1981).

- **TAKEOFF SAFETY ZONE.** The Takeoff Safety Zone (TSZ) at a heliport is an area that begins 75 feet from either side of the centerline of the runway. The width of the TSZ is 300 feet (150 feet on either side of the center line of the runway) at the end nearest the runway. The TSZ is 400 feet long and at its outer edge is 400 feet wide or 200 feet on either side of the runway

  centerline. The resulting surface is a trapezoid that flares outward from the helipad. Buildings are not permitted within this area due to the high potential for accidents.

- **APPROACH-DEPARTURE ZONE.** The Approach-Departure Zone (A-

DZ) overlays the TSZ and extends out for a distance of 1200 feet from the edge of the helipad. The shape follows the trapezoidal shape of the takeoff safety zone, so that the outer edge is 600 feet.

As can be seen in Figure 4.1, the helipads at McCoy Army Airfield are far enough from the boundary that the helicopter safety zones can be ignored for purposes of land use planning in the adjoining civilian property to the west.

4.4.3 WEAPONS SAFETY FANS.

Army policy specifies the shape of safety fans for every weapon in the Army arsenal. All safety fans for fixed ranges remain on Fort McCoy property. In addition, the Range Manual contains specific safety provisions to ensure that indirect fire does not target areas off the installation.

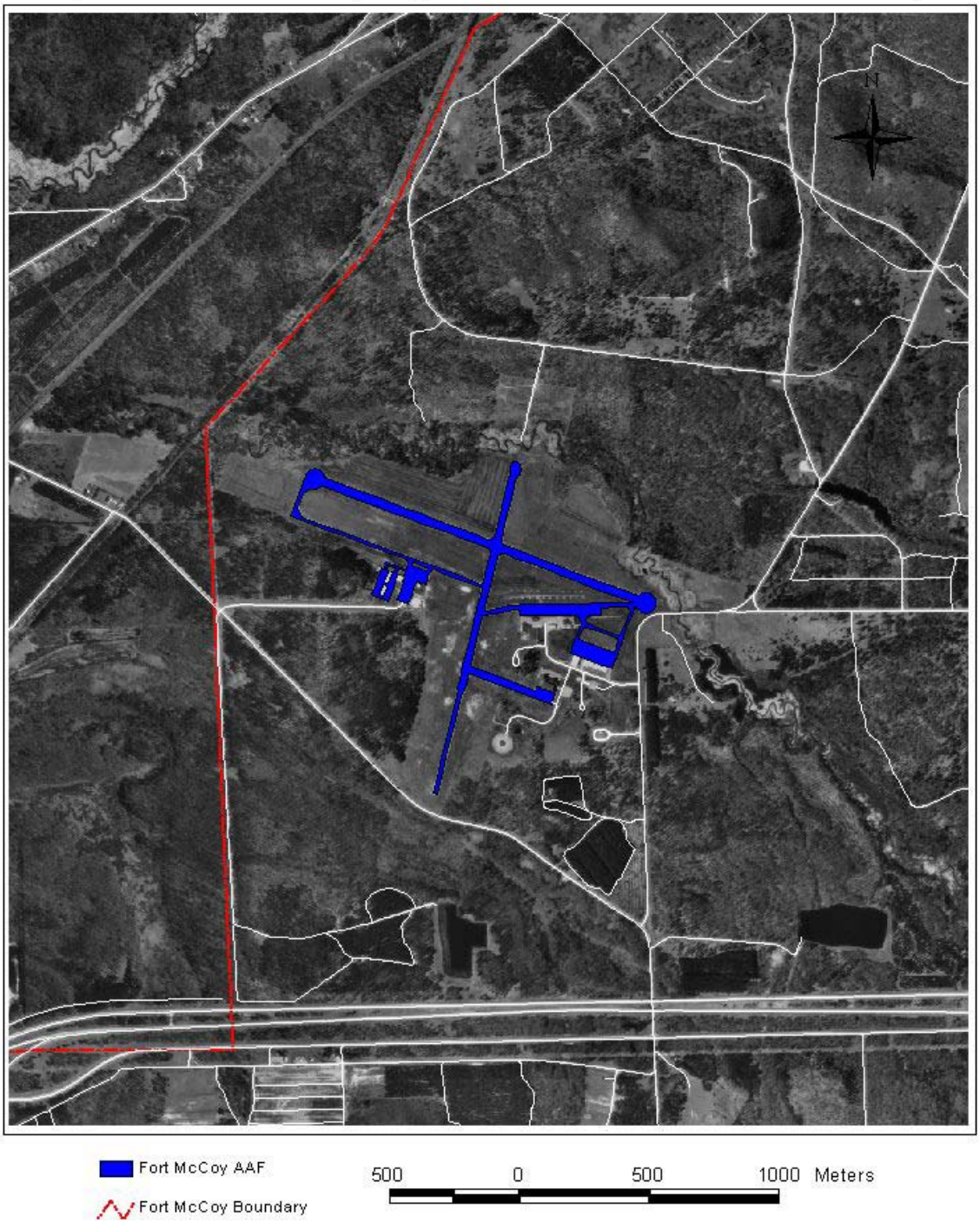
4.5 LAND USE GUIDELINES FOR NOISE.

The Federal Interagency Committee on Urban Noise (FICUN) published land use guidelines for areas on and/or near noise producing activities, such as highways, airports, and railroads (FICUN, 1980). The ICUZ program uses these guidelines for all continuous noise sources at military installations. In addition, ICUZ applies the FICUN guidelines to the sounds of small arms ranges. The ICUZ Program designates Noise Zones for land use planning. By projecting these zones onto an area map, land use guidelines can be used to help planners develop compatible land uses.

4.5.1 USE OF THE LAND USE PLANNING ZONE.

The Department of Defense has a long-standing policy (DoD 1964) to assess environmental noise around military airfields (Air Force, Navy, and Marine) using the average busy day. This policy predated the Environmental Protection Agency's (EPA) 1974 recommendation that federal agencies use the annual average. Army policy, which was written after the EPA's 1974 recommendation, incorporated the annual average. Nevertheless, litigation and the requirement to respond to public comments under the National Environmental Policy Act have led to the Army supplementing annual average analyses with busy day analyses to develop the Land Use Planning Zone contours.

Figure 4.1 Location of McCoy Army Airfield in Relation to the Installlation Boundary



Based on review of these legal precedents, recommendations are made for the use of both measures, each with a different purpose.

Later in this Section, a noise zone map for the noise of weapons of 20 mm caliber and greater is presented showing the training noise averaged over 250 training days. The two contours averaged over the 250 training days are labeled Zone II and Zone III. In addition, there is a contour line representing an exposure which is five (5) decibels less than the 250 day Zone II exposure. This contour is labeled the Land Use Planning Zone (LUPZ).

The scientific evidence in support of either the annual average or LUPZ is limited, because most social surveys are from communities experiencing about the same noise exposure from one day to the next. Nevertheless, the few studies from communities experiencing large day-to-day differences underscore the importance of considering the highest exposure. Fields and Powell (1987) demonstrated that naive subjects (people who do not know the intent of the study) make orderly judgments of the annoyance of daily exposures to helicopters (1 to 32 flights per day), and Fidell et.al. (1985) showed that naive subjects make orderly judgments of the annoyance of the past week along with the annoyance of the past year. Two other relevant findings, from Fidell et.al. are (1) that annoyance continues to accumulate as the number of continuous days of aircraft noise exposure increases and (2) it takes longer for people to forget they are annoyed after levels are lowered than it takes for them to become annoyed when levels are increased. Webb and Warren first demonstrated this asymmetry in memory with explosive noise in 1967. The subjects were English villagers who, on Mondays and Tuesdays, were subjected to 24 daily explosions at a baseline pressure of 2.6 pounds per square foot. Over the course of 14 weeks, the percentage of people expressing any annoyance dropped from 50% to 20%. Halving the pressure (6 dB decrease in noise dose) or reducing the daily number to 8 (5 dB decrease in noise dose) appeared to have no effect on the downward drift of annoyance. However, tripling the number resulted in a rebound of annoyance from 25% to 60%, with a possible “sensitization” to the standard exposure in the following week. Remembrance of past “worst case” exposures is ever present in most public hearings over the noise impact of military training.

In other words, the usefulness of the LUPZ is not as grounded in science, but rather in public demand. It is not so much a predictor of annoyance as it is a predictor of complaints. Analyses of noise complaints received by the Army have shown that short term increases in DNL, not the long term average, best predict complaints (Luz et al, 1983). In the absence of regulatory noise exposure standards, complaints have become *the de facto* standard. To our knowledge, there are no instances when a state or federal regulatory authority has come to the

Army with a Notice of Violation for noise. At the same time, there are many instances when Army commanders have voluntarily curtailed noisy activities in order to reduce complaints. Through a formal Installation Environmental Noise Management Plan, Army installations try to prevent complaints through self-monitoring of operations and partnering with land use planning efforts by local government.

Whether the LUPZ should be used for land use planning is a difficult question. If the busy day is used to characterize noise, citizens receive a better description of what will exist during a period of increased operations. A role of government is to provide its citizens with sufficient information to make intelligent decisions. Clearly, there are some people for whom a quiet environment is integral to the pursuit of happiness and others who are relatively impervious to noise. The use of LUPZ contours does provide the local community additional information to make better informed land use decisions.

4.5.2 COMMUNITY REACTION TO NOISE.

Additional justification for this downward adjustment of the noise contours is the Environmental Protection Agency (EPA) suggested corrections to the DNL. Ambient noise is the composite sound associated with the noise environment of a particular site, excluding the sound of the source of interest. The EPA found that ambient noise, along with previous community exposure and community attitudes, are important considerations in predicting community reaction (EPA 1974). The EPA's suggested corrections are listed in Table 4.1.

The EPA introduced these corrections because they resulted in a better correlation between measured DNL and community response than is observed with measured DNL by itself. These corrections date back to Air Force funded research by Rosenblith and Stevens (1953).

TABLE 4.1. Corrections to be Added to the Measured Day-Night Sound Level (DNL) of the Intruding Noise to Obtain Normalized DNL.

Type of Correction	Description	Amount of Correction
Seasonal Correction	Summer (or year-round operation)	0
	Winter only (or windows always closed)	-5
Correction for Outdoor Noise Level Measured in Absence of Intruding Noise	Quiet suburban or rural community (remote from large cities and from industrial activity or trucking)	+10
	Normal suburban community (not located near industrial activity)	+5
	Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas)	0
	Noisy urban residential community (near relatively busy roads or industrial areas)	-5
	Very noisy urban residential community	-10
Correction for Previous Exposure & Community Attitudes	No prior experience with the intruding noise	+5
	Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to the noise previously, but the people are aware that bona fide efforts are being made to control the noise.	0
	Community has had considerable previous exposure to the intruding noise and the noisemaker's relations with the community are good.	-5
	Community aware that operation, causing noise, is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances.	-10
Pure Tone or Impulse	No pure tone or impulsive character	0
	Pure tone or impulsive character present	+5

The Rosenblith-Stevens procedure accounted for the following factors:

- Magnitude of the noise with a frequency weighting relating to human response.
- Duration of the intruding noise.
- Time of year (windows open or closed).
- Time of day noise occurs.
- Outdoor noise level in the community when the intruding noise is not present.
- History of prior exposure to the noise source and attitude toward its owner.
- Existence of pure tone or impulsive character in the noise.

Corrections for these factors were initially made in 5 dB intervals since it is difficult to assess human response accurately for any smaller increment. The Air Force and the Federal Aviation Administration later simplified this model for ease of application.

The data indicate that widespread complaints may be expected when the normalized value of the outdoor A-weighted day-night sound level (ADNL) of the intruding noise exceeds the ambient noise by approximately 5 dB. Vigorous community reaction may be expected when the excess approaches 20 dB. More recent case studies demonstrating a need to adjust DNL to predict community reaction include (1) response of rural communities to increases in DNL from the low 40s to the high 40s under the FAA's Expanded East Coast Plan (Muldoon and Miller, 1989), (2) reaction of mayors of four cities around NAS Miramar to introduction of helicopters (Huard, 1999), (3) litigation at Westover AFB after introduction of the C-5A (Green, 1997), and (4) the National Resource Defense Council's finding that, despite relatively few people living within the 65 dB contour at Denver International Airport, this airport received the highest number of complaints per month among the 50 busiest airports in the U.S. (NRDC, 1995)

Another way to disclose installation activity and noise is to designate areas within a 1.6 kilometer (1 mile) buffer adjacent to the installation boundary, that are not already contained within a Noise Zone, as a Zone of Influence (ZOI). Publication of a ZOI can serve to inform the community of the installation's existence,

thereby reducing citizen concern/misunderstanding related to noise from unknown installation activities. An installation where the one-mile buffer has been used in conjunction with noise zones is Camp Bullis, Texas. This option has not been included in the Fort McCoy IENMP.

4.6 CURRENT NOISE ENVIRONMENT AT FORT MCCOY.

4.6.1 INCLUSIONS AND EXCLUSIONS.

As part of the noise complaint management effort, the Commander, Fort McCoy, has directed the staff to keep a record of the geographical locations of noise complaints. As can be seen in Figure 4.2, the two primary reasons for complaints are low-flying aircraft and large guns. Complaints are not being received about small arms range noise or the noise of aircraft operations at McCoy Army Airfield. While the absence of complaints is not, in itself, a reason for excluding a noise source from consideration under an IENMP, there are objective reasons for excluding small arms range and airfield noise. As explained earlier in Para 2.2.4, an unbaffled small arms range is not a problem if potentially-developable land is not any closer than 500 meters behind the firing line. No developable or developed land are Fort McCoy is closer than 500 meters to small arms firing lines. At the McCoy-Sparta airfield, estimated to have 27 military flights per day, there is very little likelihood that private land would be exposed to a busy day DNL 65.

This low likelihood can be illustrated with the use of some real numbers on the Sound Exposure Level (SEL) from the UH-60A helicopter. The SEL is a single number in which the total noise exposure from a passing aircraft has been normalized to one-second. Table 4.2 lists the UH-60A SEL values determined by the Federal Aviation Administration (FAA, 1981).

Knowing the SEL of a helicopter makes it easy to calculate the DNL. The SEL represents the sound energy normalized to one second. So, if there is only one flight per day, the DNL can be calculated by subtracting a constant representing 10 times the logarithm of the 86,400 seconds in a 24 hour day, which is 49.4. For example, if 49.4 is subtracted from 89.4, the DNL at 164 meters to the right of the UH-60A flying at 1500 feet would be estimated as 40 dB. If the single flight took place between the hours of 10:00 PM and 7:00 AM the next morning, the SEL would receive a 10 dB penalty, and the DNL from one night flight would be 50 dB.

Figure 4.2 Distribution of Noise complaints around Fort McCoy

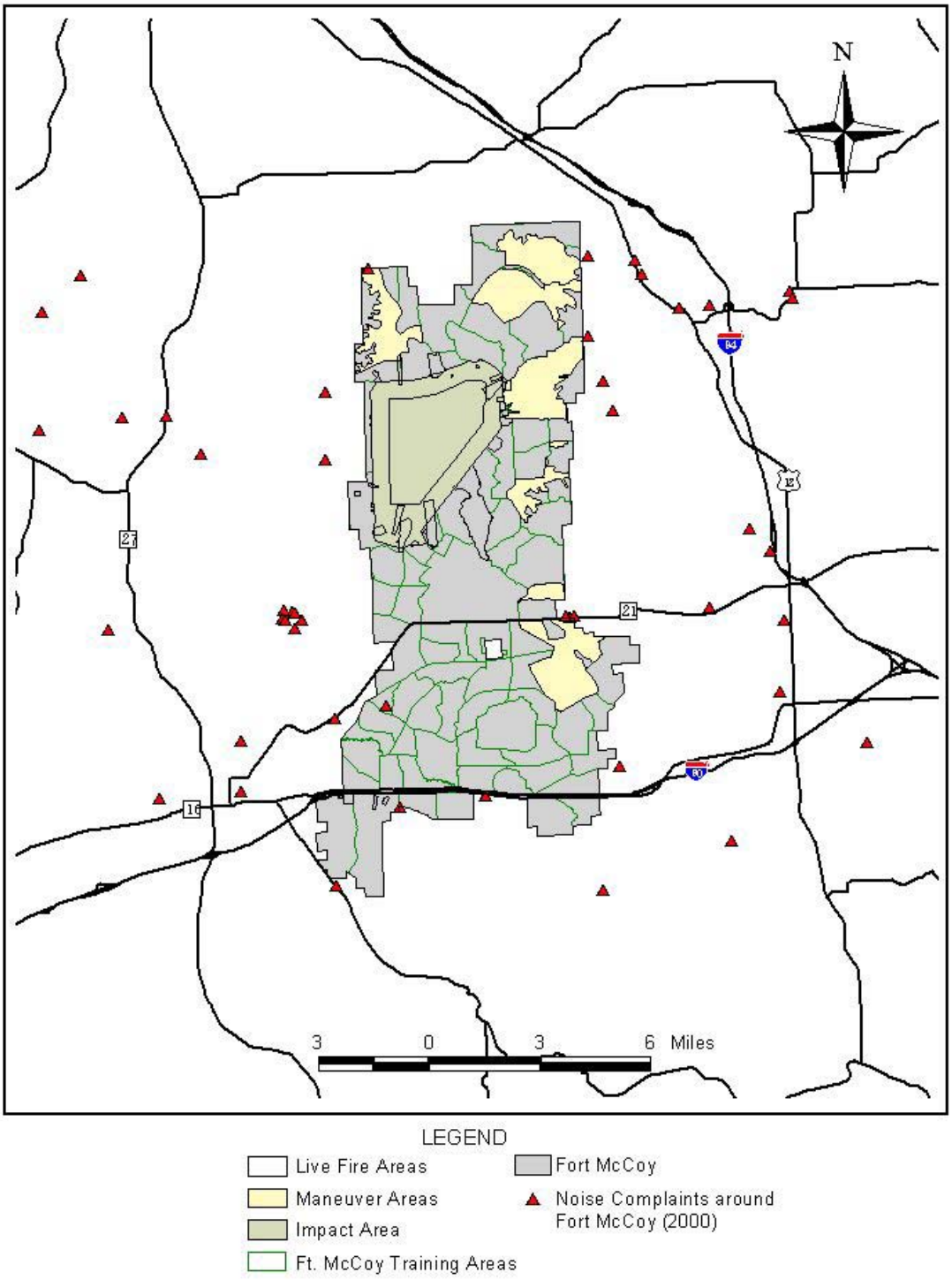


Table 4.2. FAA Sideline Measurements of SEL of UH-60A in Level Flight at 150 Knots and Altitudes of 300, 700, 1000 and 1500 Ft AGL.

Feet Above Ground Level	SEL at150 Meters Left of Flight Track*	SEL at164 Meters Right of Flight Track**
300	94.2	94.4
700	92.5	93.6
1000	90.5	91.6
1500	88.5	89.4

* from Table A.1-3.5 of FAA (1981)
* from Table A.1-3.4 of FAA (1981

To achieve a busy day DNL 65 with 27 flights per 24 hours, the UH-60 pilots would have to be flying at a relatively low altitude along a narrowly defined flight track. In Table 4.2, the highest SEL, 94.4 dB was observed at 164 meters to the right of a flight track with the aircraft flying 300 feet above ground level (AGL). Table 4.3 shows the resulting DNL from different mixes of day and night flights. To achieve a busy day DNL65 at the hypothetical location, eight (8) of the 27 flights would have to take place between 2200 and 0700.

Table 4.3 DNL at 164 meters to the Right of Twenty-Seven UH-60A Helicopters Flying Past at 300 Feet AGL.

Flights between 0700-2200	Flights between 2200-0700	DNL
27	0	59.3
26	1	60.6
25	2	61.6
24	3	62.4
23	4	63.0
22	5	63.6
21	6	64.1
20	7	64.6
19	8	65.0

4.6.2 HELICOPTER NOE ROUTES.

When Fort McCoy's neighbors do encounter a helicopter, the pilot is probably flying to or from one of four Nap of the Earth (NOE) routes. The locations of the four NOE routes are shown in Figure 4.3. While the pilot is flying NOE, disturbance to people living near the NOE route is negligible, because one of the purposes of flying NOE is to avoid auditory detection by the enemy. (Another purpose is to be unseen by enemies armed with machine guns or shoulder-fired rockets.) Flying close to the ground results in much of the sound being attenuated by the sides of stream valleys, tree leaves, tree trunks and the detritus on the forest floor. Depending on the situation, it is possible for a number of "*occasional flights"* to pass a home on the way to or from an NOE route.

4.6.2.1 Community Annoyance from Occasional Flights.

There have not been many studies of the annoyance of occasional helicopter over flights. Undoubtedly, the best was published by Fields and Powell (1987) in the Journal of the Acoustical Society of America. These two NASA researchers were funded by the Federal Aviation Administration to study the annoyance of helicopter noise, and they conducted the study with two Army helicopters, the old UH-1H (the Huey) and the newer UH-60 (the Blackhawk). The study area was near Fort Eustis, Virginia, and the subjects were people who lived near a flight path for the Army airfield. Thus, the subjects were accustomed to hearing helicopters.

During the study, Fields and Powell controlled the number and altitude of daily flights in a 500 meter strip along a 6 kilometer flight path. They asked the pilots to fly at one of two altitudes: 500 or 1500 feet AGL. They also controlled the numbers of daily flights; permutations were 1 or 2 or 4 or 8 or 16 or 32 flights per day. The subjects, who did not know that this was a study of helicopter noise, were paid $40 to be interviewed by telephone. At the end of each experimental day, the subjects were asked to rate the annoyance of cars, trucks, motor cycle, jet airplanes, the neighbors' tools/yard equipment and any other disturbing sound.

Figure 4.3 Location of Fort McCoy's Four Nap-of-the-Earth Routes

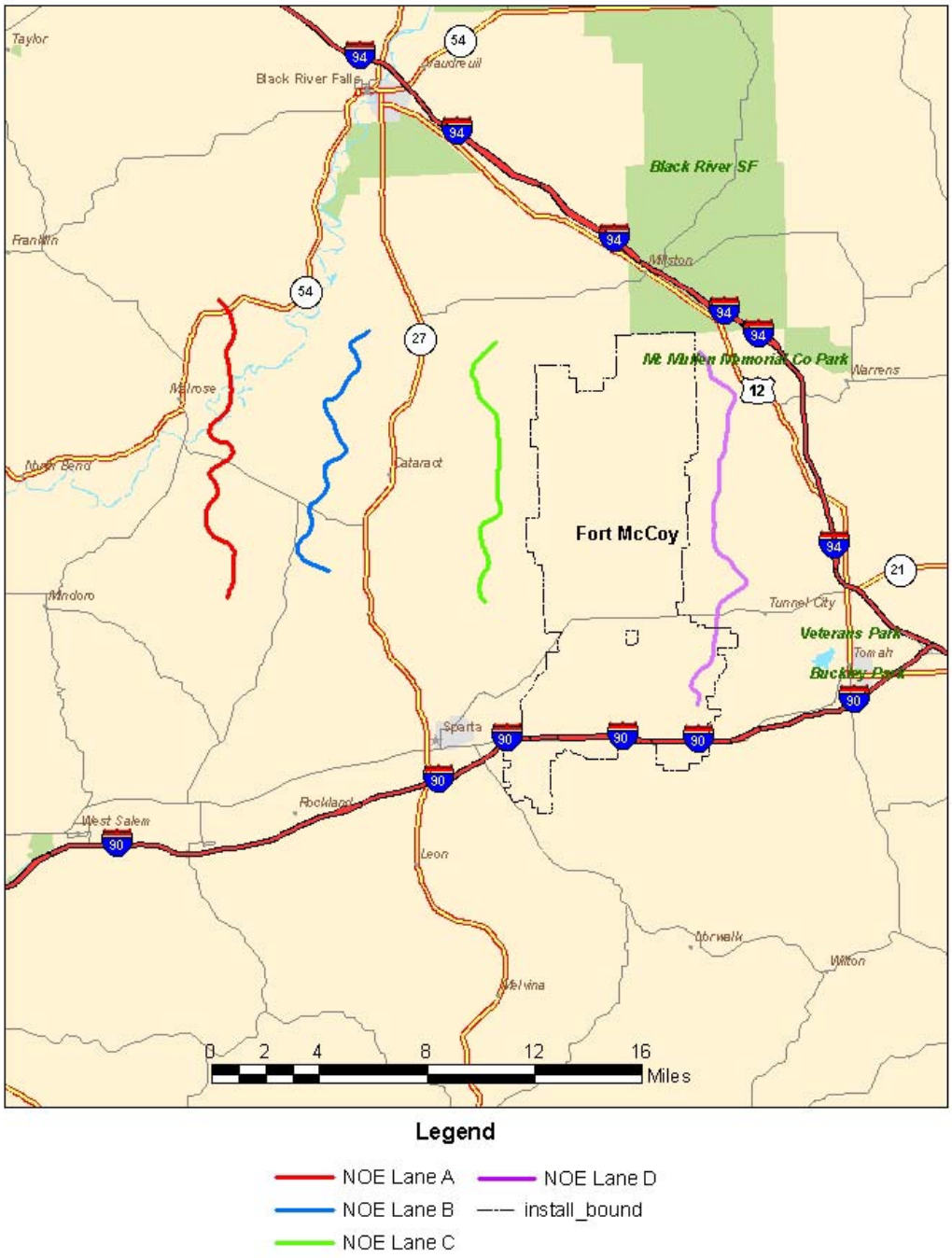
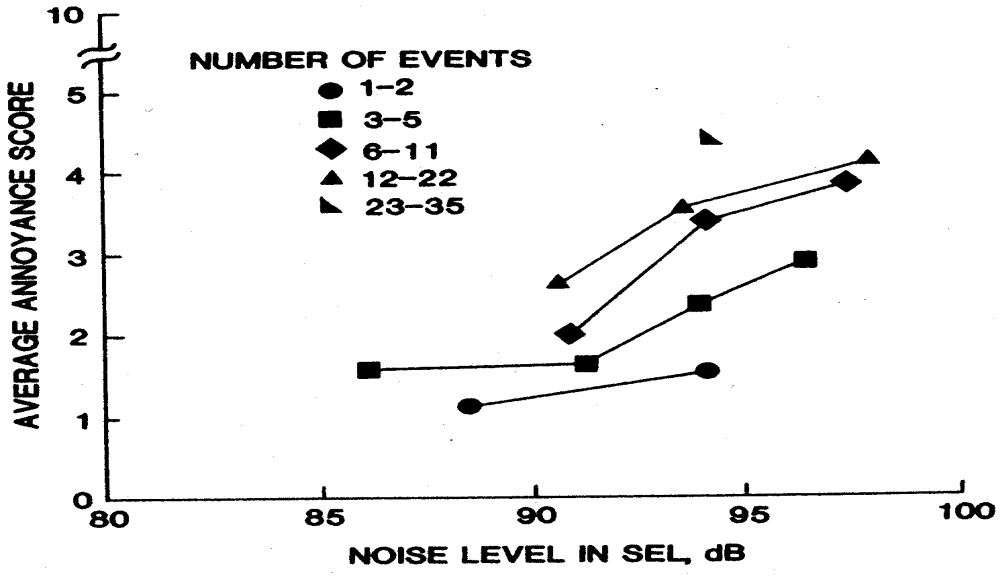


Figure 4.4 shows the relationship between the ratings given to helicopters and the number of helicopters at each noise level during the day. The measure of noise shown is the Sound Exposure Level or SEL. [The SEL is a measure of the total acoustic energy of the over flight.] Figure 4.4 shows that the average person in the study was not particularly annoyed by a helicopter with an SEL less than 90 dB but was increasingly annoyed as the SEL climbed above 90 dB. Thus, as the number of daily flights with an SEL of 94 dB increased, the daily annoyance rating also increased.

In interpreting Figure 4.4, it is important to remember that the ratings on the vertical axis are averages. Thus, some of the individuals were much more annoyed and some were much less annoyed than indicated by the average rating.

Figure 4.4 Effect of the Noise Level of Individual Helicopter Flights and the Daily Number of Flights on the Daily Annoyance Rating of Naïve Listeners Experiencing the Helicopter Noise in their Own Homes (from Fields and Powell, 1987).



4.6.2.2 Additional Reasons for Helicopter Noise Complaints.

It is also important to recognize that many experts have concluded that the SEL from a helicopter is more annoying than an equal decibel SEL from a jet aircraft. For example, the 1977 Department of Defense Instruction on Air Installation Compatible Use Zones (AICUZ) stated that 7 dB should be added to helicopter "meter readings obtained under conditions where blade slap was present until and unless meters are developed which more accurately reflect true conditions (DOD, 1977). Similarly, Norwegian regulators added a 5 dB penalty to helicopter noise because of "impulsivity." By itself, "impulsivity" fails as an explanation for the annoyance of helicopters. Norwegian researchers could not find evidence for a 5 dB penalty when subjects judged the annoyance of high quality tape recordings (Gjestland et. al., 1992), and Fields and Powell (1987) found no difference in the annoyance of the blade-slap prone UH-1H and the less blade-slap prone UH-60A.

Although "blade slap" appears to have been a blind alley in understanding community response to helicopter noise, communities do seem to be more annoyed by helicopter noise than by jet aircraft noise. Here are two examples:

In the London community of Lower Feltham, where the contribution of fixed and rotary wing aircraft to the overall noise exposure was about equal, the percentages of people who considered helicopters more and much more disturbing than fixed-wing aircraft were 2 to 2.5 as large as the percentages who considered helicopters less and much less disturbing. In the communities of Esher and Epsom, where the numbers of helicopters and a fixed wing aircraft were about equal, the disturbance due to helicopter noise was 2.5 times as large as that due to fixed wing aircraft noise. People were more annoyed by the helicopters, even though, on average, the fixed-wing aircraft were 5 dBA more intense (Atkins, 1983; Atkins et.al., 1983, Prescott-Clarke, 1983).

At a Decatur, Illinois airport where the DNL was determined by fixed wing aircraft and there were less than two UH-1H

operations per week, 7% of the people exposed to a DNL of 66

dBA reported themselves to be "highly annoyed" by helicopters (Schomer, 1983).

In short, people are more likely to notice or be annoyed by a helicopter than a jet aircraft with an equal SEL. There are five possible reasons why people living in a helicopter flight corridor might show an enhanced response to helicopter noise:

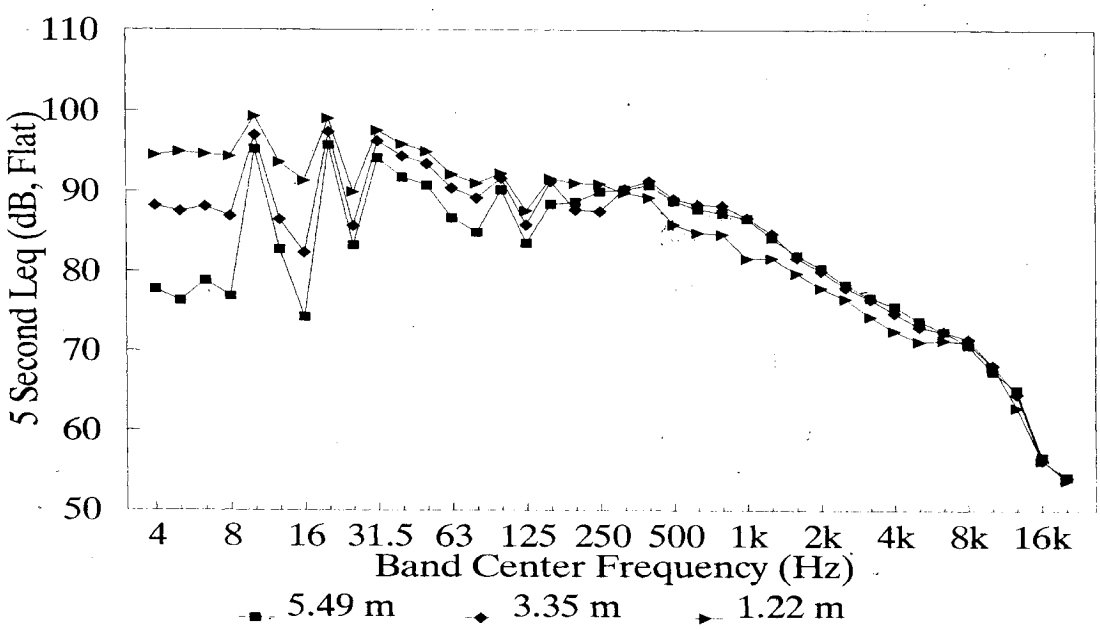
- Helicopters Heard at Long Distances. Helicopters have an acoustic directivity, and each model of helicopter has its own unique directivity. Sound propagates in the direction of rotation of the main rotor blade. Because the primary sound frequency in the main rotor blade is the number of rotations per second, the sound of the main rotor can propagate long distances without the atmospheric attenuation typical of higher sound frequencies.

- Low Frequency Sound Penetrates Windows. The A-weighting filters out low frequency sound, but most windows do a poor job of filtering out low frequency sound. As shown in Figure 4.5, the acoustic signature of a helicopter contains a sizable amount of low frequency sound, and when these low frequencies penetrate into a room, they can cause the rattling of bric-a-brac and chandeliers. Also, loosely-mounted windows are prone to rattle. Isolation from sound in one's home is one of the modifiers to noise annoyance substantiated by Fields (1993).

- Invasion of Privacy People may feel that their privacy is invaded when a helicopter flies close to their home.

- Pilot Choice People may feel that the helicopter pilot has a choice about flying over their house. Belief that the noise maker has a choice is one of the modifiers to noise annoyance substantiated by Fields (1993).

Figure 4.5 Spectrum of a typical helicopter



Leq spectra at 30.5 meters, IGE mode, for three microphone heights (averaged over both trials and six helicopter bearings).

- Fear People may be afraid that a low flying helicopter could crash into their house. Fear of danger from the noise source is one of the modifiers to noise annoyance substantiated by Fields (1993).

4.6.2.3 RESPONSES OF ANIMALS TO HELICOPTER FLIGHTS.

Another possible concern is the effect of occasional helicopter flights on either domestic animals or wildlife. Predicting animal response to helicopter flights is a complex subject. Rather than discuss this question in the body of the IENMP, the available information has been provided in Appendix D, Information on the Response of Animals to Low Level Flights by Helicopters. Based on Figures D.1 and D.2 in the Appendix, it appears that grazing animals and raptors are not disturbed if helicopters do not fly closer than 400 meters/1300 feet (slant distance). As shown in Table 4.4, the maximum sound level of Army

helicopters at this distance is not particularly loud. Available research suggests that it is not the sound, per se, but the combination of sound with the visual image of the helicopter that disturbs animals. Thus, a wild animal at 400 meters from a helicopter flying NOE in a thick Wisconsin forest would probably not be disturbed, since the helicopter would not be visible.

Table 4.4 A-Weighted Maximum Sound Level at Different Distances from Aircraft Flown at Fort McCoy.

DISTANCE IN FEET	CH-47D	UH-60A	C-130	C12
100	93.2	97.1	105.4	93.6
125	91.1	95.1	103.3	91.6
160	89.1	93.0	101.2	89.6
200	87.0	91.0	99.1	87.6
250	84.9	88.9	96.9	85.6
315	82.7	86.8	94.7	83.5
400	80.5	84.7	92.5	81.5
500	78.3	82.5	90.2	79.4
630	76.1	80.3	87.9	77.4
800	73.8	78.1	85.5	75.3
1000	71.4	75.9	83.0	73.2
1250	69.0	73.5	80.5	71.1
1600	66.5	71.2	77.9	68.9
2000	64.0	68.7	75.2	66.7
2500	61.3	66.1	72.4	64.5
3150	58.6	63.5	69.5	62.2
4000	55.8	60.7	66.4	59.9

4.7 LARGE WEAPONS.

The noise contours for large weapons are shown in Figure 4.6. These contours are similar to the set published in 1994 (U.S. Army, 1994a) and reproduced as Figure 4.7. The earlier blast noise contours included the firing of 155 mm howitzers, 8 inch howitzers, 107 mm mortars and 81 mm mortars. The new set of reflects the firing of 155 mm howitzers, the Multiple Launch Rocket System (MLRS) which has replaced the 8

inch

Figure 4.6 Blast Noise Contours for Current Operations at Fort McCoy

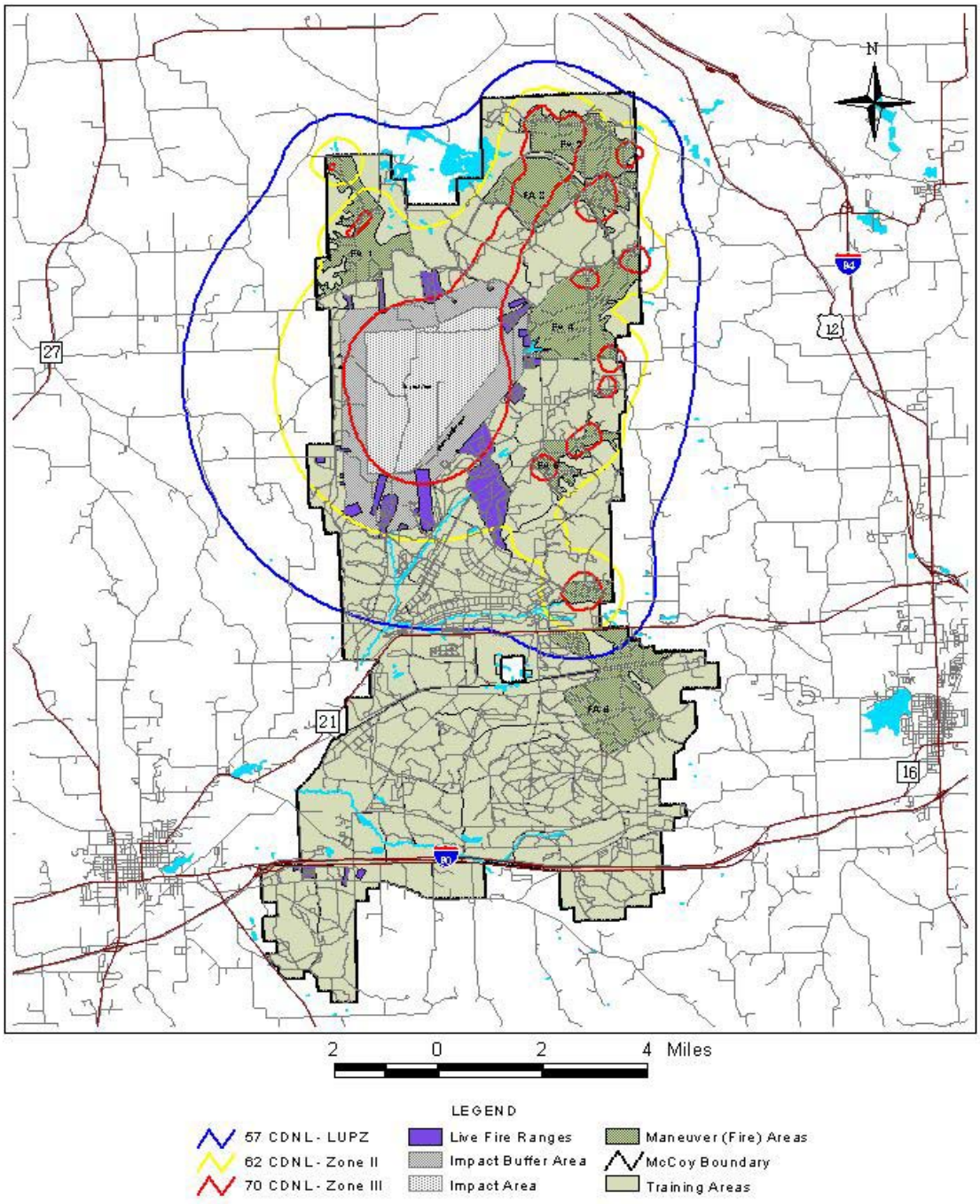
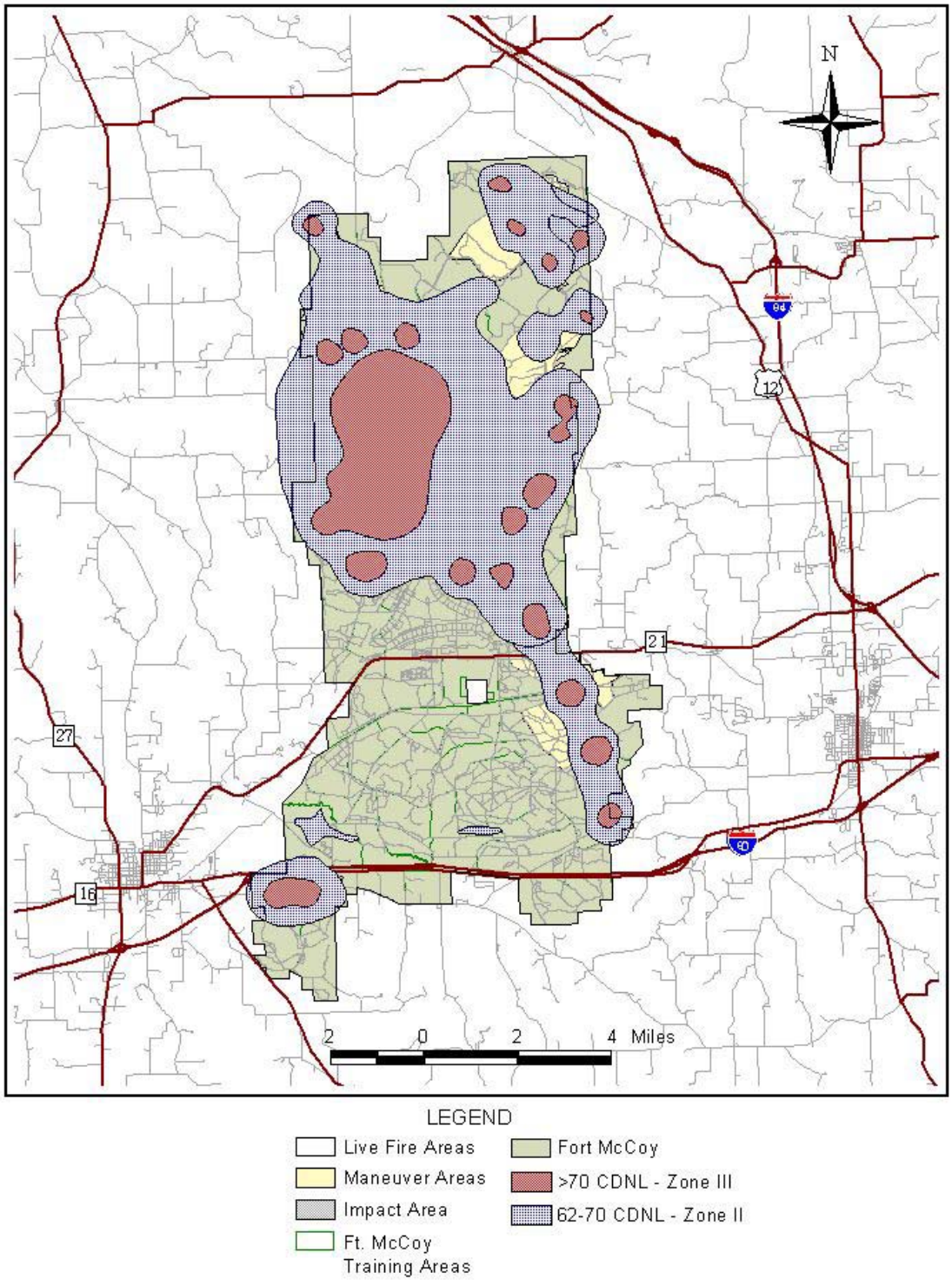


Figure 4.7 Blast Noise Contours for Operations in 1993



howitzer, and 105 mm howitzers. Table 4.5 lists the ammunition included in these contours. All rounds listed in Table 4.5 result in noise being generated at the firing point. Only rounds labeled High Explosive (HE) result in noise in the impact area. During the period surveyed, there was no tank gunnery ammunition fired on Range 29. Had tank gunnery taken place, the noise contours would probably have been somewhat larger. As noted earlier, firing was averaged over 250 days. The LUPZ is representative of the Zone II during a 24 hour period when the volume of firing is three times greater than the (250 day) daily average.

Currently, there are a few homes located within the Zone II (normally incompatible with residential use). Although there are some hills around the impact area, their height is not sufficient to shield these homes from blast noise. The highest barrier is found to the west of the impact area where the crest of the hill is 70 meters above the plain of the impact area. Distance between the impact area and the crest of the hill is 2.5 km, and houses are located 1.0 km farther west. According to Dr. Michael White, USACERL, the barrier effect in this case is negligible (White, 2003).

Table 4.5 Annual Volume of Ammunition Used for Blast Noise Contours.

Type of Ammunition	Fired by Day	Fired by Night
105 mm high explosive	635	71
105 mm illumination	93	10
105 mm white phosphorus	25	3
155 mm high explosive	9370	1041
155 mm illumination	730	81
155 mm white phosphorus	387	43
155 mm smoke	53	6
MRLS Practice Rounds	217	24

4.8 DEMOLITION RANGES.

It is difficult to model the C-weighted DNL from a demolitions range, because units have considerable latitude in determining the size of charges, the number of charges and the depth of burial. Typically, these details are obscured in the records kept at Army range control offices. What is known, however, is the maximum allowable surface charge. The maximum allowable surface charge at the Heavy Demolition Range is 250 lbs Net Explosive Weight (NEW), and the closest someone could build a house is about 2 km from that range. The predictions of peak blast level at 2 km from a 250 lb charge are available from a module of BNOISE2, “One Shot.” Because variations in the weather

cause variation in the efficiency of sound propagation, "One Shot" provides statistical probabilities. Table 4.6 gives the percentage of firings during which different peak levels would be exceeded at 2 km.

Table 4.6 Distribution of Linear Peak Exceedance Levels at 2 Kilometers from a Surface Charge of 250 Lbs Net Explosive Weight.

Peak Level Exceeded	Percentage of Times Peak Level is Exceeded
150	0.13%
148	2,28%
139	15.87%
129	50.00%
120	84.13%
114	97.72%

When contemplating noise limit criteria for demolition noise, one finds very little objective guidance available. Factors to be considered include the possibilities of structural damage to buildings and physiological damage to humans, and the likelihood of receiving noise complaints. Siskind (1989) found that homeowners become concerned about structural rattling and possible damage when the level exceeds 120 decibels peak (dBP). It appears that the first structural damage to occur as impulse sound intensity increases is window breakage. The threshold to crack a poorly mounted window pane is approximately 150 dBP. The threshold for physiological damage is approximately 140 dBP. The threshold for annoyance at levels lower than 140 dBP, varies greatly among individuals. More information on interpreting the levels in Table 4.6 is provided in Sections 4.9 and 4.10 below. Helpful hints on avoiding the worst case levels shown in Table 4.6 are provided in Section 4.11.

Because a 250 lb detonation is rare, the likelihood of the worst case shown in Table 4.6 is proportionately low. A far more common size charge is 10 lbs. This charge is detonated on the light demo range, which is about 500 meters from the boundary and about 1 km from the closest house. Table 4.7 shows the peak levels associated with various probability levels at distances of 1, 2 and 3.2 km from a 10 lb surface detonation. For a 155 mm howitzer HE round, which contains 15 lbs of explosive, levels would be 1.5 dB higher than in Table 4.7.

Table 4.7 Peak Exceedance Statistics at Distances of 1, 2 and 3.2 km from a 10 lb

Charge.

Percentage of Times Peak Level is Exceeded	Peak Level Exceeded		
	at 1 km	at 2 km	at 3.2 km
0.13%	150.0	145.0	137.5
2,28%	149.5	138.5	129.5
15.87%	140.5	129.5	120.5
50.00%	129.0	119.5	111.0
84.13%	119.5	110.5	102.5
97.72%	115.0	104.5	96.5

4.9 COMPLAINT POTENTIAL OF INDIVIDUAL INTENSE BLASTS.

One way to evaluate the complaint potential from impulsive noise is a set of guidelines (Pater 1976) developed by the Naval Surface Warfare Center, Dalhgren, Virginia. These guidelines for delaying tests at Dahlgren were based on over 10 years experience using meteorological forecasts. The guidelines are shown in Table 4.8. These levels resulted from the best compromise between cost, efficiency of range operations, and good community relations.

4.10 SIGNIFICANCE OF HOUSE VIBRATION.

The impulsive sound pressure from the firing of large weapon systems and the detonating of explosive charges can cause structures to vibrate. This vibration is perceived by the occupants as the rattling of loose windows and objects on shelves. At many Army installations, homeowners have expressed concern about this vibration causing damage to their residences. The following discussion shows why the source of structural vibration in areas adjacent to Fort McCoy is related to airborne sound not ground borne (seismic) vibration.

GROUND-BORNE VIBRATION.

House shaking is commonly blamed on ground-borne vibration. Studies of vibration caused by coalmine detonations (Northwestern University 1981) indicate that the ground-borne vibration dominates house vibration at scaled distances of less than 50. At scaled distances greater than 50, the airborne vibration dominates.

Table 4.8. Impulse Noise Guidelines.

Predicted Sound Level, DBP	Risk of Complaints	Action
< 115	Low risk of noise complaints.	Fire all programs
115 – 130	Moderate risk of noise complaints.	Fire important tests. Postpone non-critical testing, if feasible.
130 – 140	High risk of noise complaints, possibility of damage.	Only extremely important tests should be fired.
> 140	Threshold for permanent physiological damage to unprotected human ears. High risk of physiological and structural damage claims.	Postpone all explosive operations.

Note: For rapid fire test programs and/or programs that involve many repetitions of impulse noise, reduce allowed sound levels by 15 dBP.

That is, for a 100-pound charge, the ground-borne vibration is the dominant cause of house vibration if the house is located less than 500 feet from the detonation point. At distances greater than 500 feet, the airborne sound wave is the dominant cause of the vibration.

Humans can typically perceive ground-borne vibrations as low as 0.08 to 0.20 inches per second (Argonne 1993). A summary of typical vibration levels is listed in Table 4.9.

The maximum ground-borne vibration level recommended by the U.S. Bureau of Mines (Bureau of Mines 1980a) to prevent threshold damage is 0.5 inches per second. The threshold level at which minor structural damage may begin to occur in 0.01 percent of structures is set at 2.0 inches per second.
Using the models developed in the above study, the maximum predicted ground vibration at 2 (1.25 miles), 4 (2.5 miles), and 8 (5 miles) kilometers for a 155-mm howitzer round detonating in the impact area is 0.0014, 0.00052, and 0.00019 inches per second,

respectively. For a 500-pound bomb, the maximum ground vibration is 0.00926, 0.00333, and 0.00119 inches per second.

TABLE 4.9 Typical Vibration Levels.

Type of response	Ground Vibration, inches per sec
Human:	
Perceptible	0.08.
Noticeable	0.2
Unpleasant	0.38
Disturbing	0.8
Objectionable	1.3
Structure:	
Minor Damage (fine cracks in plaster	5.4
Major Damage	7.6

VIBRATION FROM AIRBORNE SOUND.

Airborne sound is the dominant cause of vibration of structures off the installation. Most of the studies of airborne vibration and the damage guidelines derived from these studies used sonic booms as the source. The vibration from artillery and tank main gun firing is similar to the vibration from sonic booms.

Structural shaking or window rattling by airborne sound can annoy the occupants and cause possible structural damage. The vibration levels and corresponding unweighted-peak- sound-pressure levels for annoyance and damage (Siskind 1989) are listed in Table 4.10

Table 4.10 Airborne Vibration Levels.

Response	Vibration Level (inches per sec)	Peak Sound Level (dBP)
Concern by Homeowner about Structural Rattling and Possible Damage	0.1	120
Glass and Plaster Cracks Under Worst Case Condition	0.5	134
Structural Damage to Lightweight Superstructure	>2.0	175

***Worst case = Poorly fitted loose window glass and stressed plaster walls**

VIBRATION DAMAGE GUIDELINES.

Structures exposed to high energy-impulsive noise can crack for a variety of reasons that have nothing to do with the vibration and noise environment. Considerable knowledge exists on natural forces and mechanisms that cause structural damage (U.S. Air Force 1990c). These natural forces and mechanisms include:

- Ratio of inside to outside surface and air temperatures.
- Range of inside and outside humidity. Temperature and humidity influence the amount of shrinking of wood frame members which is a major source of cracking of interior surfaces.
- Intensity, duration and direction of wind.
- Uneven settling of building foundation.
- Room volume, wall and ceiling area (high walls and cathedral ceilings). The larger the surface area of a wall or ceiling, the more likely it is to crack from expansion and shrinkage.
- Orientation and partial shading of wall from sunlight (uneven heating causes uneven expansion of walls).
- Type of skin, frame, exterior materials and interior finish.
- History of patching.

- Presence of water leaking from or condensing on interior pipes and from external sources into building structure.

The strength of many materials can reduce after repeated events. This reduction of strength is known as fatigue. However, the effect of fatigue on damage prediction is negligible because of the following:

- Use of conservative estimates of damage threshold levels for materials in order to compensate for weakening by fatigue on material strength.

- Brittle materials, such as glass, show little reduction in strength due to fatigue.

- Fatigue in ductile materials, such as most metals and wood, requires approximately one million events to reduce the strength of the material by 50 percent.

- Normal preventive maintenance on a structure will negate the effect of fatigue.

The most common form of structural damage from vibration caused by artillery and tank-main gun firing is window breakage. There have been several studies of the probability of window breakage. The results from one study (FAA 1976) are summarized in Table 4.11.

VIBRATION STUDIES.

An extensive study of vibration in the homes of residents who were concerned about structural damage from gun noise was performed by USACHPPM (U.S. Army 1994). The study showed that the homes were exposed to levels well below the threshold levels for damage. A typical wood-frame building close to the firing points was used as a control site. Even though this building was exposed to levels several times higher than the threshold level, no damage occurred.

During the extreme cold and wet of the 1994 winter, the CHPPM team monitored the noise and vibration at eight homes on the Eastern Shore of the Chesapeake Bay, Maryland, and at a building near the firing points at Aberdeen Proving Ground (APG) (U.S. Army 1994b).

TABLE 4.11 Probability Of Window Breakage.

Pressure in pounds per square foot	Decibels Linear Peak	Probability of Breakage per million pane events*
1	128	0.28
10	148	5,000
100	168	380,000

The threshold level used to evaluate window damage claims against the Army (U.S. Army 1994a) is 136.5 unweighted peak decibels (dBP). This level is more conservative than the 140 dBP used by the U.S. Bureau of Mines (Bureau of Mines 1980b).

* Number of window panes broken
for each million panes exposed to the blast event.

At the eight homes, only two of the over 10,000 vibration measurements exceeded the known damage thresholds. At the APG wood-frame building, the majority of the measurements of the blast noise exceeded these thresholds. The only damage that has occurred to this structure since it was built in 1986 is minor plasterboard cracking at high stress points. The data from this study are summarized in Table 4.12

Further analyses of these noise and vibration data showed an excellent correlation between the unweighted peak sound pressure (Pascals) and the peak vibration (inches per second). For a sample of 523 data sets, the correlation between the sound and window vibration is 0.936, sound and midwall 0.932, and sound and corner 0.918. These show that the unweighted peak sound level is an excellent predictor of the damage potential caused by airborne vibration.

The U.S. Army Corps of Engineers Waterways Experiment Station (U.S. Army 1987b) measured the ground-borne vibration caused by the explosion of two 2,000 pound bombs at Fort Carson. The total equivalent TNT explosive weight is 2,400 pounds. The vibration was measured at four sites between 4,350 and 8,100 meters (14,300 and 26,600 feet) from the explosion. The vibration measurements are summarized in Table 4.13.

TABLE 4.12 Summary Of Data From Apg Study.

	Noise		Vibration, inches per second					
	DBP		Window		Wall		Corner	
Site	Mean	Max	Mean	Max	Mean	Max	Mean	Max
1	111.7	132.4	0.643	3.318	0.189	1.124	0.041	0.570
2	108.4	124.8	0.506	2.605	0.127	0.701	0.019	0.100
3	106.6	127.8	0.289	0.991	0.085	0.336	0.016	0.178
4	110.5	134.7	0.440	2.200	0.173	1.450	0.057	0.224
5	109.4	128.1	0.464	2.093	0.108	0.662	0.017	0.116
6	109.8	125.9	0.232	0.883	0.157	0.693	0.022	0.336
7	106.8	126.0	0.269	0.843	0.106	0.328	0.016	0.100
8	111.2	131.3	0.798	7.012	0.307	3.356	0.020	0.340
APG	127.2	149.8	2.070	8.930	1.245	5.834	0.219	6.550

TABLE 4.13 SUMMARY Of Fort Carson Vibration Measurements.

Distance	Vibration, inches per second		
Meters	Vertical	Radial	Transverse
4,350	0.083	0.171	0.046
4,600	0.075	0.11	0.034
7,900	0.007	0.0036	0.0012
8,100	0.0056	0.0028	0.0008

Analyses of the measurements revealed that the vibration was caused by the airborne pressure wave passing over the ground motion sensors. The ground-borne vibration levels were below the threshold level of the instrumentation. All of the measurements were below the threshold levels for damage. The measured levels at the 7,900 and 8,100 meter sites were approximately equivalent to the vibration levels produced by vehicular traffic at 30 meters.

4.11 MITIGATION.

Acoustical engineers categorize the technology for mitigating noise into ***source, path*** and ***receiver***.

- When dealing with military weapons, aircraft and vehicles, mitigating at the source is not viable, and Congress specifically exempted DoD from source mitigation by excluding combat materiel from the definition of a ***product*** in the Noise Control Act of 1972. In some situations, helicopter pilots are able to achieve noise reduction at

the source by altering the way they fly. The effort to train pilots to reduce helicopter noise is known as the "Fly Neighborly Program" (HAI, 1993), and the Army organization responsible for "Fly Neighborly" training is the Army Aeronautical Services Agency at Fort Belvoir, Virginia.

- Mitigation along the path of propagation refers to the use of berms or vegetation to absorb some of the sound. It is also possible to mitigate along the path by waiting for a time when the weather is unfavorable between the noise source and the receiver. Ordinarily, waiting for the "best case" condition for making a lot of noise is only feasible at a weapons testing ground, such as Aberdeen Proving Ground, MD, or the Naval Surface Weapons Center, Dahlgren, VA. The one possible exception at Fort McCoy would involve an unusually large demolition at the Heavy Demolition Range. The maximum weight limits at Fort McCoy have been set to where no one is expected to complain about demolitions training. If it should ever become necessary to mitigate noise levels, there is a simplified technique to assist range operators in avoiding complaints. The technique was developed by the Explosives Research Group (ERG) (University of Utah 1958) to predict atmospheric refraction conditions. The ERG technique summarizes the results of this research into a series of "good" and "bad" firing times. These results are listed in Table 4.14. This technique provides a good first approximation of the effects of the existing weather conditions on noise propagation.

- Mitigation at the receiver includes both the construction of buildings so that the occupants will be less bothered by noise and noise complaint management. For aircraft noise and traffic noise, there is a large body of information about ways to increase the outdoor-to-indoor attenuation of sound. This body of information is not applicable to gunfire, because the low frequency energy in the sound of large guns penetrates through doors and windows more efficiently than the higher frequency sound energy in aircraft and traffic noise. Also, the low frequency sound of large guns results in house vibration. As discussed at in Section 4.11 below, the Army has published some work on the mitigation of vibration through the architectural design of houses. However, this work is dated and may be of limited use for contractors using newer construction materials. The importance of noise complaint management has already been addressed in Section 4.3 above, and this discussion will not be repeated here.

TABLE 4.14 . "Good" And "Bad" Firing Conditions.

"Good" Conditions	"Bad" Conditions
CLEAR SKIES WITH BILLOWY CLOUD FORMATIONS, ESPECIALLY DURING WARM PERIODS OF THE YEAR A RISING BAROMETER IMMEDIATELY FOLLOWING A STORM	DAYS OF STEADY WINDS OF 5-10 MPH WITH GUSTS OF GREATER VELOCITIES (ABOVE 20 MPH) IN THE DIRECTION OF RESIDENCES CLOSE BY. CLEAR DAYS ON WHICH "LAYERING" OF SMOKE OR FOG ARE OBSERVED. COLD HAZY OR FOGGY MORNINGS. DAYS FOLLOWING A DAY WHEN LARGE EXTREMES OF TEMPERATURE (ABOUT 36 DEGREES F) BETWEEN DAY AND NIGHT ARE NOTED. GENERALLY HIGH BAROMETER READINGS WITH LOW TEMPERATURES

4.12 MITIGATION THROUGH ARCHITECTURAL CONTROLS.

A number of researchers have shown that intrusive sound accompanied by vibration is much more annoying than the same decibel level of intrusive sound without vibration. In Japan, Sato (1994) found that a 10 decibel increase in the vibration associated with traffic or railroad noise had the same effect on annoyance as increasing the 24 hour LEQ by 3.5 dBA. In a more controlled German laboratory study, Paulsen and Kastka (1995) demonstrated that the presence of vibration from a railway amplified the annoyance associated with sound levels between 30 and 60 dBA. In Sweden, Öhrström (1997) concluded that when homes are exposed simultaneously exposed to railroad noise and vibration, mitigation of the vibration or a longer distance between houses and the railway line is needed, corresponding to a 10 dBA lower noise level than in areas without vibration. Schomer and Neathammer (1987) demonstrated that when the sound of a passing helicopter was accompanied by rattle, the annoyance increased by over 10 dBA. Working with simulated blasts, Schomer and Averbuch (1989) found that the contribution of rattle to annoyance depended on the sound level of the intrusive sound. With an outdoor blast level of 112 dBP, the presence of rattle added an effective 13 dB to the annoyance, whereas with an outdoor blast level of 122 dBP, rattle added an effective to annoyance.

Researchers have also shown that the reduction of rattle can reduce annoyance. In Japan, Ochiai and Yamashita (1989) looked at the annoyance associated with the rattling of Japanese style sliding doors. The found that the most effective method of reducing rattle was fixing the doors to the frame by rubber packing. Working with the solid masonry construction of German houses, Schomer et al (1991) were able to achieve a 14 dB improvement in community response by adding a second pane to the windows separated with a small air gap.

The propensity for a house to rattle in response to low frequency noise depends to a large degree on the mass of the building. Obviously, the walls of a stone house will not rattle, but loosely-hung windows in a stone house will rattle. Similarly, a "green construction" straw bale house would not be prone to rattle. In a review of the perception of noise induced house vibrations, Hubbard (1982) showed that the threshold for rattle was lowest in windows, higher in walls and highest in floors.

Information on rattle-prone architectural features is available in a report authored by Schomer et. al. (1987). The following lists of desirable and undesirable architectural features in a low frequency noise environment has been reproduced from that report.

Windows There are seven basic types of windows: fixed, casement, awning, sliding, double-hung, jalousie, and pivoting.

DO use a fixed window if outdoor air is not required.

DO use a casement or awning window which can be secured firmly against a gasket.

DO use gasket material liberally to reduce the gap between the sash and track and to soften the impact when these two components make contact. A second advantage is the improved reduction in heat loss.

DO encase the double-hung window sash weights in a soft plastic jacket to soften the contact when the weight vibrates.

DO apply a small felt disk to the lower edge of each jalousie window element to prevent a window to window contact. Manufacturers should bond a soft plastic sleeve to the window edge to prevent heat loss and rattle.

DON'T allow the jalousie window opening mechanism to become loose and worn. All shafts should rotate in soft plastic bushings. All gear clearances should be minimized. Linkage should be encased in soft plastic sleeves.

DON'T allow the window hardware to loosen. Inspect the hardware periodically and

apply preventive maintenance.

DON'T use a sliding, double-hung, jalousie, or pivoting window as a new or replacement window due to the gaps which exist between the sash and track.

Doors Doors operate by swinging, bypass sliding, surface sliding, pocket sliding, and side-hinge folding. There are flush, paneled, French, glass sash, jalousie, louvered, shuttered, screen and Dutch doors.

DO use swinging paneled doors for the home exterior. Swinging and side-hinged folding doors should be used in the home.

DO use a single- rather than a multiple-element garage door. Weatherstrip the building jamb and allow minimum clearance between the overhead track and the roller. Encase the springs in soft plastic jackets.

DO avoid French, Dutch, jalousie, louvered, and shutter doors. If used, separate the door elements using soft plastic foam or weatherstripping-type materials.

DO use a plastic screen instead of a metal screen.

DO insure that the door hardware is in good repair. Minimize the gaps in lockset tongues where the tongue fits into the jamb. Insure that hinge pints are tight and coated with plastic. Place a soft plastic foam or felt strip on door mail slots to prevent hard contact.
DON'T use lightly constructed screen doors. Enclose the safety chain in a soft plastic sleeve and insure that the hardware is tight and in good repair.

DON'T use sliding doors, particularly the pocket sliding type. If sliding doors must be used, do not hang the door loosely from the ceiling but use a bottom track also. The gap between the track and the door should be minimized. A track liner of soft plastic or weatherstripping-like material will minimize contact.

Ceiling Systems

DO insure that enclosed lighting fixtures are well made with minimum gaps. Insure that the sheet metal housing is stiff and well secured at its contact points.

DON'T use a dropped acoustical tile ceiling. If one is used, insure that contact

between vertical wires and joist and metal frame is eliminated.

DON'T use light fixtures that hang from the ceiling by a chain or similar device. Also, avoid light fixtures with loose elements.

Miscellaneous Items Including Bric-a-Brac

DO install soft plastic foam or weatherstripping-like material to the lower edge of the back of the hanging mirrors and picture frames to prevent direct contact by the frame or mirror with the wall.

DO separate small items placed on shelves, in closets, or on other horizontal surfaces from these surfaces by using small felt or foam disks or strips glued to the underside of the item.

DO separate plates placed horizontally on shelves using soft plastic foam doilies.

DO insure that window air-conditioners are installed properly. The refrigeration coils should be separated. Air intake and exhaust louvers should be separated by foam strips or disks.

DO keep downspouts and gutters in good repair. Insure that all seams are tight and covered with duct tape.

DON'T allow home heating ducts and registers to loosen. Use duct tape around all seams.

4.13 OTHER CONSIDERATIONS.

4.13.1 ANNOYANCE OUTSIDE THE NOISE CONTOURS.

As suggested by the map of noise complaints presented above, people living near Fort McCoy but outside of the noise contours may still annoyed and could complain about the noise environment. The amount of annoyance also depends on the time of day the noise takes place, the background noise environment, and whether the person is indoors or outdoors at the time. The annoyance and complaint potential from single events, such as a 120 mm tank gun round on the MPRC or the throbbing low frequency of an approaching helicopter, is highly subjective. Data are limited in this area.

The usual complaint pattern is that economic activity unrelated to the installation stimulates increased population and development in the vicinity. Segments of the

new population are not economically dependent on the installation, and tend to be annoyed by the noise or other aspects of the government presence. The noise from the ranges provides a specific and undeniable object to complain about. As time goes on, the complainers become more articulate and eventually address their complaints to higher levels of command and government. When the situation becomes political, the installation's mission can be jeopardized.

Individual response of community members to noise depends on many factors. Some of these factors are the characteristics of the noise, including the intensity and spectral characteristics, duration, repetitions, abruptness of onset or cessation, and the noise climate or background noise against which a particular noise event occurs. Social surveys show that the following are all factors related to annoyance:

- The degree of interference of the noise with activity.
- The previous experience of the community with the particular noise.
- The time of day during which the intruding noise occurs.
- Fear of personal danger associated with the activities of the noise sources.
- Socioeconomic status and educational level of the community.
- The extent the people believe that the noise output could be controlled.

4.13.2 NATIONAL ENVIRONMENTAL POLICY ACT.

Feasible noise mitigation is also investigated during the National Environmental Policy Act (NEPA) process for new operations and proposed changes in existing operations. Computer modeling of new training sites offers the prospect of predicting whether the proposed action will be compatible with adjacent land use.

This is a proactive technique in that it offers the opportunity to eliminate sites from consideration before the undesirable effects of noise ever become a factor. It also allows the installation to minimize the noise impact when designing sites.

4.14 SUMMARY.

This section provided a discussion of the Installation Environmental Noise Management Plan (IENMP) along with detailed information about the noise environment at Fort

McCoy. The purpose of the IENMP is to assist Fort McCoy in managing its noise environment, with a minimal impact on its mission, while being a good neighbor. The IENMP expands on the Installation Compatible Use Zone (ICUZ) program to include education, complaint management, noise mitigation and vibration.

The sounds of military training can be heard beyond the military reservation boundary. Although hearing the sound of military training does not, in itself, constitute an adverse environmental impact, there are examples from other military installations in which citizens have even complained about hearing military training noise. Therefore, officials at Fort McCoy depend upon the goodwill and cooperation of the civilian sector to promote public support for and understanding of the installation's mission requirements. Although a number of positive steps have been taken by Fort McCoy to minimize the unfavorable effects of noise and hazards to the public welfare and safety, these unilateral actions do not guarantee that the post will be able to carry out its training mission on into the indefinite future. Suggestions on ways for the installation and the community to work together are contained in Section 5.

SECTION FIVE

ARMY & COMMUNITY RESPONSIBILITIES

5.1 INTRODUCTION.

This section addresses the responsibilities of the Army and the civilian communities around Fort McCoy with respect to the Installation Environmental Noise Management Plan (IENMP). In the civilian sector, responsibility for integrating noise considerations and safety of humans and property into the land use planning process rests with state and local governments. Within the military sector, consideration of these noise management issues is the responsibility of the installation Commander. Neither can work in isolation. The emphasis of this section is the joint nature of environmental noise management.

Noise is considered to be one of the most important aspects of the environmental quality of life and needs to be considered in the planning process. Failure to do so can only result in irritation, complaints, and possibly legal action, all of which are detrimental to a harmonious relationship between Fort McCoy and the citizens who live in the surrounding areas. Recommendations to achieve compatibility between the needs of the civilian community and Fort McCoy training responsibilities are provided in this section.

5.2 LAND USE GUIDELINES.

Land use guidelines are meant to ensure compatibility with the noise environment while allowing maximum beneficial use of contiguous property. The Department of the Army has no desire to recommend land use regulations that render property economically useless. It does have an obligation to the communities around Fort McCoy and the citizens of the United States to point out ways to protect both the people in adjacent areas and the public investment in the installation.

5.3 NOISE IMPLICATIONS.

The analysis of the noise impacts upon privately owned land around the Fort McCoy shows that a few citizens are exposed to noise that exceeds the levels recommended under federal land use guidelines (FICUN 1980).

Currently, Fort McCoy and the citizens of Monroe County are in a symbiotic relationship. Fort McCoy provides jobs and protects a number of rare, threatened or endangered species. In return, a handful of people are exposed to annoying levels of noise a few times each year. The computer analysis shows that Fort McCoy's noise has not changed over the past decade. However, there are two scenarios that could shift the balance. The first would be an increased tempo of training at Fort McCoy. The second

would be the development of land near the ranges and impact area in the northern third of the installation. Because of the proximity to I-94 and the Black River State Forest, the open land on the east side appears to have greater potential for construction of up-scale homes than the somewhat noisier land on the west side. Because neither scenario appears to be likely at this time, Fort McCoy and Monroe County still have an opportunity to prevent future problems through land use planning.

A "near-miss" in December 1998 underscores the importance of beginning land-use planning now. At that time, a developer of up-scale homes approached Monroe County with a proposal to buy county-owned forest land along the west side of the impact area. Because this property is not on the tax roles, its development would have been advantageous to county government. Nevertheless, county government decided not to sell the property. Had this property been developed, it is very likely that the new owners would have complained about blast noise, because much of the land is at a higher altitude than the impact area. Based on Army experience in California, large homes located on hill tops are particularly prone to vibration, because of large rooms and large picture windows. In addition to being annoyed by hearing the rattle of bric-a-brac, homeowners are annoyed when blasts trigger burglar alarms in cars and on windows.

5.4 SAFETY IMPLICATIONS.

The analysis of the safety impacts shows that the clear zones and accident potential zones for the airfield remain on installation. All weapons safety fans are also on the installation.

5.5 ARMY RESPONSIBILITIES.

The military officials at Fort McCoy view the IENMP as two-fold. The first responsibility is to ensure that all possible steps have been taken to reduce the noise and safety impacts generated by military training and operations. The second is to be an active and willing participant in an ongoing cooperative educating and planning process through which compatible land use plans can be developed by local citizens through their elected representatives.

RESPONSIBILITY FOR NOISE IMPACT REDUCTION.

The IENMP describes the Army's and Fort McCoy's responsibilities for reducing the impact of the noise environment on the surrounding communities.

The reduction of noise levels in commercial equipment is being fulfilled by the use of equipment that complies with federal emission standards. In addition, Fort McCoy has

taken the following specific actions to limit noise exposure:

- Officials investigate noise complaints and plot the locations of complainants on a map in order to understand the nature of the complaints and ways to avoid disturbing Fort McCoy's neighbors in future operations.

- Range Control has imposed a 250 lb demolition weight limit.

RESPONSIBILITY FOR PARTICIPATION WITH LOCAL COMMUNITIES.

This report is one effort to fulfill Fort McCoy's responsibility to the local communities by notifying elected officials, civic and business organizations, and other interested persons of its willingness to cooperate in noise management and promotion of the safety of humans and property. These responsibilities include:

- **EDUCATION.** Fort McCoy has the civic responsibility to educate, through media releases, public meetings and open houses, the surrounding communities about its mission. This education also includes what Fort McCoy is doing to reduce the impact of noise.

- **NOISE COMPLAINT MANAGEMENT.** Fort McCoy has the responsibility to maintain good public relations with its neighbors by being responsive to the concerns of these neighbors.

- **LAND USE RECOMMENDATIONS.** Officials at Fort McCoy stand ready to provide local governments with recommendations for land uses that are compatible with the noise levels produced by, and the hazards to safety created by, military training and operations.

- **MITIGATIVE ACTIONS.** All reasonable actions to reduce noise during periods requested by local officials, as well as actions to resolve individual complaints are considered.

5.6 CIVILIAN COMMUNITY RESPONSIBILITIES.

Local government planning responsibilities include the protection of the environmental quality of life of the community and protection of individual and community investments. As discussed in Paragraph 5.3, Monroe County has already demonstrated its willingness to protect the community by not selling forest land on the west side of the impact area for residential development. Appendix E contains a detailed discussion of the various options available to county government to implement land use planning around a military installation.

5.7 RECOMMENDATIONS.

In providing recommendations, neither the Army nor anyone at Fort McCoy has any desire to make privately owned land economically useless. However, when the current land use around Fort McCoy is considered, it becomes apparent that actions are appropriate to guide the future development of the surrounding or adjoining private property. Failure to do so creates a long-term threat to Fort McCoy's future usefulness to the Department of Defense. The following recommendations are offered in a spirit of mutual cooperation.

5.7.1 FORT MCCOY.

The following specific recommendations are provided to promote the orderly use and development of land for purposes that are compatible with Fort McCoy mission requirements and the needs and concerns of the surrounding civilian community.

- Share the information in this INEMP with Monroe County government. Copies of the IENMP can be provided to the Tomah and Sparta City libraries as had been done with the 1996 ICUZ study.

- If there is an interest, sponsor a one-day seminar to teach local officials and any interested citizens about military noise, how it is assessed and how it can be mitigated. Assistance is available from the U.S. Army Center for Health Promotion and Preventive Medicine (CHPPM) for presenting such a seminar.

- In cooperation with Monroe County officials, discuss the merits of incorporating a scenario of maximum range utilization into a county land use plan.

- Continue the current noise complaint management effort and include the noise complaint telephone number on the Fort McCoy website.

- Develop a short and simple brochure on the Fort McCoy noise environment, to include the blast noise contour map, its interpretation, and guidelines on rattle-proofing buildings against low frequency sound. This new brochure would replace the 1996 brochure.

- Request pilots conducting flight operations in and around Fort McCoy to stay at least 400 meters away from domestic animals or protected wildlife.

- Request that pilots adhere to the Fly Neighborly guidelines.

- Choose a set of fixed flight corridors for accessing Nap of the Earth routes, provide maps of these corridors to the owners of over flown properties, and make sure that pilots fly within the corridors.

- Request that the Installation Management Agency (IMA) promulgate uniform aircraft noise management guidelines for all installations.

5.7.2 MONROE COUNTY.

Determine the best way to share the information on Fort McCoy noise with people who already own noise-impacted property and people who are considering building homes on noise-impacted property.

In cooperation with Fort McCoy officials, discuss the merits of incorporating a scenario of maximum range utilization into a county land use plan

5.7.3 JACKSON COUNTY.

There are no recommendations for Jackson County. Although a small portion of the LUPZ from the noise of large weapons does encroach into Jackson County, the area inside the LUPZ is part of Black River State Forest.

SECTION SIX

COMMUNITY INVOLVEMENT

6.1 PURPOSE OF COMMUNITY INVOLVEMENT.

Beginning with the passage of the National Environmental Policy Act in 1969, U.S. military installations have been involved in conveying environmental information to their neighbors. Out of the "lessons learned," environmental professionals have developed guidelines on community involvement programs. A successful Installation Environmental Noise Management Plan requires negotiated mutual agreements with neighboring civilian communities to promote compatible land use in areas around installations. The Environmental Noise Management Program objectives are to protect the installation operational capability from the effects of incompatible land use and to assist local, regional, state and federal officials.

The purposes of the community involvement program are to:

- Maintain the military installation's position as a good neighbor in the community.
- Inform the community of alternative actions and their potential impacts.
- Solicit information from the public regarding possible impacts, future development in the community, and the acceptability of proposed actions.
- Maintain an open and visible decision-making process that is fair and equitable to different people within the community.

6.2 PURPOSE OF THIS SECTION.

The purpose of this section is to lay out the basics of a community involvement program. Since most of the discussion applies to any environmental medium (e.g. air pollution, water pollution), the information in this section may be applicable to other land use planning issues at Fort McCoy.

6.3 INTRODUCTION.

The specific techniques to be used for community involvement will be at the discretion of the installation commander and staff, taking into account the unique circumstances of the installation, the degree of controversy surrounding noise and other issues at the installation, and the characteristics of the local political institutions. But installation commanders will be asked to follow a carefully-designed thought process which will help

them think through the design of their community involvement programs in an orderly and systematic manner.

Implicit in this thought process is the recognition that people are different. Some people may be concerned because they hold an official position in the community, others because the noise or other issues impact directly on them, others because they are concerned with how the community is growing, and others because they hold real estate in noise-impacted areas which they want to develop in the future. To be credible to the community, any agreement needs win acceptance not only of elected leaders, but also of those people that see themselves as having a stake in the issue.

The Army's experience with noise and other environmental issues suggests that most people will not be interested in the Environmental Noise Management (IENMP) process unless they are directly impacted by these issues such as, planning regulations, changes in tax rates, or some other direct impact.

But even when dealing with only part of the community, there are differences in the kind of information you can give or get from various people. The number of people that can understand the technical complexities of acoustical measurement is extremely small, but the opinion of this small technical group of people can be very important. They often influence whether public officials accept the IENMP study. Thus, it is important to balance the technical aspects of noise based on the people involved. In other words: "Do not tell people how to build a watch when all they want to know is the time." The general attitudes towards the base, perceptions of whether or not there is a noise problem etc. is the key to success or failure.

The reason it is so important to carefully target the people you want to reach is that this determines the techniques you will use. An appropriate technique for reviewing the technical methods might be a small technical advisory group. But if you want general public perceptions you might hold community workshops in noise-impacted neighborhoods, or conduct a number of interviews.

The person implementing a community involvement program will need to go through this kind of analysis in order to select from the considerable array of community involvement techniques which have been developed, including:

- Public Meetings
- Public Hearings

- Informal Workshops
- Coffee Klatches
- Interviews
- Field Trips
- Advisory Committees or Task Forces
- Computer-Based Interactive Graphics
- Homepages
- Questionnaires, Response Forms, Polls
- Open Houses
- Brochures
- Newsletters
- Hot Lines
- News Releases

This list is not exhaustive, but simply includes the most frequently used techniques, or techniques which may have particular suitability for noise-related community involvement.

6.4 DESIGNING A COMMUNITY INVOLVEMENT PROGRAM.

Environmental noise management community involvement programs will usually not be a single event, such as one public hearing, but rather a series of coordinated activities which provide different kinds of participation opportunities at different times. Unlike the National Environmental Policy Act (NEPA) process, environmental noise management requires continuous community involvement.

There is no single community involvement program that can be prescribed for all circumstances. A program that has been very successful in one situation may be ineffective in another. The following will provide guidance to assist in identifying a

community involvement program suitable to your circumstances. This guidance will include both general principles and "thought processes" which will help you approach the design of community involvement programs in a logical manner. It should be remembered, however, that there are a number of special conditions surrounding each installation that can also influence the selection of community involvement techniques. Many of these conditions are described later in this section. These conditions do not negate the thought process, but are in addition to it.

6.4.1 GENERAL PRINCIPLES.

Practical experience with community involvement has lead to four general observations about community involvement programs.

Different people from the community will be involved at different stages of the decision-making process. A community involvement program - unless it lasts only a very short time - is not a simple linear thing. Rather, public participation will expand and contract. During technical phases, participation is likely to be limited to leaders of groups and interests, or staffs of agencies. In those phases where alternatives are being considered, a broader community based group may be involved.

There are appropriate levels of involvement at each step in the decision-making process. It is possible to attempt "too much" community involvement at a particular step in the decision-making process. In particular, many agencies have "burned out" public enthusiasm by creating a very high level of interest at the very beginning of the process - where there is relatively little in which the general public can really get involved - disappointing people who might have made an important contribution in later stages of decision making. This often leads to them turning off the entire process. While this applies to the general public, opportunities for early participation should certainly be offered to other local, state, and federal agencies, identifiable interest groups, or directly impacted people. The thought process will assist you in identifying the most appropriate stages for more intense involvement of the general public.

The participation of the public will increase as the decision-making process progresses. While participation waxes and wanes, the overall pattern in community involvement is that more and more people will participate as you come nearer to a decision. This is a relatively understandable phenomenon: the closer you get to a decision, the more information there is for people to react to. While representatives of organized groups may be able to participate in the early stages of community involvement, the less organized people will be able to participate more effectively in the later stages of the process. This can be a mixed

blessing. While you may feel delighted to receive more participation, you will also spend a lot of time explaining what has already taken place. People seem to assume that the program started the day they first began to participate, and feel a need to re-examine all the assumptions you've been working to build for many months. As a result, it is very important to document how people from the community have participated in the study, so that it is clear what decisions have preceded and who participated in making those decisions.

Community involvement programs must be integrated with the Environmental Noise Management Program. Each step of the community involvement program must be scheduled with an eye to what information is required from the public at each stage. Too often community involvement activities are scheduled "ad hoc," without any awareness of how it fits in the overall scheme of things. The result is that the information received from the public is out of sequence with the decision-making process. Either the information is too late, and can't be used any longer or would require major re-study, or the community involvement is too early and asks for participation before there is really much for the community to "sink its teeth into." In either event there is frustration and damage to the credibility of the community involvement effort. As the thought process below will illustrate, community involvement activities should be designed as an integrated part of the decision-making process itself.

6.4.2 COMMUNITY INVOLVEMENT THOUGHT PROCESS.

Community involvement techniques should not be selected on a whim, but as the result of a careful analysis of exactly what it is you wish to accomplish, with whom, and only then, how, where, and when. The community involvement process must be integrated with and facilitate the Environmental Noise Management Program, rather than being added on to it as a final review.

To achieve this integration of the Environmental Noise Management Program and the community involvement process, it is necessary to think first about the program's progress and needs, and how community involvement might meet those needs and facilitate that progress.

IDENTIFY DECISION-MAKING PROCESS.

Each of the IENMP stages, as listed below and described in paragraph 1.1.5, is logically related to the stages that may precede and follow it. Each stage has its own decision making process. It is important, at the beginning of the

development of the community involvement plan for each stage, to decide where in the program the community involvement process will best fit.

Stage 1: Quantify the installation's noise environment.

Stage 2: Identify noise-impacted areas.

Stage 3: Identify existing and potential incompatible land uses.

Stage 4: Identify alternative actions to mitigate/minimize noise impacts.

Stage 5: Evaluate alternative actions.

Stage 6: Develop agreements with local communities and agencies.

Stage 7: Submit agreements for review by decision-makers.

Stage 8: Publish final IENMP and implement agreements.

Stage 9: Update and review.

IDENTIFY THE OBJECTIVES.

Because the community involvement process must help the study move along rather than impede or stop it, it is important to clearly identify what it is that the program must achieve at each stage in order to move ahead. The identification of program objectives should be specific (for example, an objective might be to update the installation's data base about land use surrounding the facility; another might be to verify public perception of noise in comparison to presumptions about noise impact as portrayed by the contour maps.)

IDENTIFY CONSTRAINTS AND OPPORTUNITIES.

Before proceeding to identify the more specific community involvement activities, consideration should be given to those factors that might impede or advance the program and its community involvement process at each stage. Factors such as program schedule and budget limits, or command support, will affect the scope of community involvement action. Some installations may have considerable community controversy about noise problems, while some may not. In some communities there are already groups organized to work on noise problems, in others there are not. The noise problems at some installations may have attracted the attention of powerful political figures, but this may not be so at

other places.

All of these special conditions can affect your community involvement planning. Table 6.1 summarizes many of the most important of these factors.

Table 6.1 How Various Factors May Affect Selection of Community Involvement Techniques.

Limited Alternatives	**If controversial, look first for approaches to expand the range of alternatives: Limited alternatives may prevent achieving an agreement.**
Limited Resources	**Attempt to get multiplier effect by getting interest groups to involve their membership. Expend resources on the period after alternatives have been identified but before plan selection.**
Duration of Program	**Prolonged decision-making processes may require use of techniques to maintain visibility over a prolonged period, e.g., newsletters or an advisory committee.**
Technical Complexity	**May need an advisory group that can get thoroughly informed. Need for publications to simplify technical concepts. May have to work most closely with other agencies and interest groups rather than "man on the street."**
High Level of Interest	**Need to offer a variety of involvement opportunities. Use techniques stressing conflict resolution rather than speechmaking, e.g., workshops rather than hearings.**

Low Level of Interest	**If interest very low, consider whether a community involvement program is needed. Early part of program includes public information program on how the issue could affect the community.**
Interest in Community	**Use of techniques aimed specifically at interested people.**
Limited to a Few People	**Use interviews, workshops or advisory committees rather than public meetings or hearings.**
Community Interest is Very Broad	**Use media to inform public. Use highly visible techniques such as meetings, workshops, newspaper inserts, etc.**
Noise Issues have High Level of Significance	**Put emphasis on conflict resolution techniques, such as small group discussions, workshops, newspaper inserts, etc.**
Uninformed Community	**Requires public information program. Work with interest groups to get them to inform their membership.**
Highly Informed	**Check whether or not they are accurately Community informed. Public information needs based on this appraisal.**
Hostile Community	**Create opportunities for ventilation of feelings. May need a series of meetings before things start being productive.**
Apathetic Community	**Provide public information program so people can decide whether or not to participate.**
Unified Community	**May be able to work through elected figures.**
Divided Community	**Will have to deal with leadership of the various interests. Danger that this issue will get caught up in continuing community controversy.**
State or National People	**May need to use newsletter or even**

Interested	**briefings in State capitol or Washington, DC to keep all people informed.**
Highly Representative Local Political Institutions	**Potential for dealing through local representatives.**
Compact Geographic Area	**Potential for meetings, workshops, and face-to-face discussions.**
Dispersed Geographic Area	**May need to rely on newspaper inserts, mail-in or phone-in responses. Any meetings will have to be repeated in several geographic locations.**
Low Credibility of Army	**Need to stay with "safe" traditional forms of participation.**
Past History of Community Involvement	**If successful, either repeats past practices or consider innovative techniques. If unsuccessful, stay with "proven" techniques for that community**

IDENTIFY THE COMMUNITY INVOLVEMENT OBJECTIVES.

There may be more than one objective for community involvement at some stages of the Environmental Noise Management Program. It is important to be specific in identifying these objectives.

Here are some examples of community involvement objectives that may be appropriate to the noise program - but note that the special needs, constraints, and opportunities at each military installation will require the development of a list of objectives that are specific to that facility.

IDENTIFY THE INFORMATION EXCHANGE WHICH MUST TAKE PLACE WITH THE COMMUNITY.

In the proceeding, you defined where you wanted to be at the end of each stage of the noise program. In this step, you will need to define what information you will need to exchange with the community in order to complete the IENMP. There is information you must give the community, and information you must get from the community.

NOISE PROGRAM STAGE OBJECTIVES	COMMUNITY INVOLVEMENT
Identify noise-impacted areas.	Identify the level of community interest in program.
	Identify community perceptions regarding the significance of noise problems at the installation.
Identify existing or potential incompatible land uses.	Identify existing land uses in noise impacted areas.
	Identify land uses anticipated in the future.
Identify alternative actions to minimize noise impacts.	Identify alternative actions which the community believes could be taken to mitigate existing incompatible uses.
Evaluate alternative actions.	Identify community perceptions about the possible impacts of each of the alternatives.
	Determine the acceptability of each of the alternatives to the community.
Negotiate agreements with local communities and agencies.	Identify mutually acceptable actions to be taken by the communities, and actions to be taken by the installation.
Submit agreements for review decision-makers.	Determine acceptability of draft plans of by decision-makers.
Publish final report describing and technical documentation.	Inform community of agreements reached.agreements
Implement agreements.	Determine community concerns about how the agreement is implemented.
Update and review.	Identify continuing or new noise problems.

Thinking first, about what you need to get from the community can help you to define better, and more easily, what it is that you need to give to them. Thinking about this information exchange in a logical/organized sequence can help you avoid information omissions and/or overkill.

IDENTIFY THE INFORMATION SOURCES IN THE COMMUNITY.

You will not be dealing with the same people at each stage of the program. And, at some stages, the information from the community may come from different people than those you gave your information to. (For example, you may ask the mayor of a municipality for information about the local plans and zoning after giving him a briefing on the noise program; but the information you get may come from the Planning Director who is responding to directives from the mayor.)

During relatively technical stages of the program, you may be dealing primarily with a leadership group - governmental staff, technicians, or leaders of interest groups. They may be the only ones with the background information, technical knowledge, or interest to sustain their involvement in the program.

When you are dealing with issues of how things "should" be, then a much larger public may have to be included. To determine the community's attitude about future growth, you may need to deal with a broad cross section of community interests.

IDENTIFY THE COMMUNITY INVOLVEMENT TECHNIQUES TO USE WITH THE PUBLIC.

All of the analysis of the community involvement thought process have been leading to where you will decide how to get the job done. If you have applied this thought process at each stage of the Environmental Noise Management Program, you will arrive at this step knowing these things:

- What you need to accomplish at each stage of the program, and why you are going to involve the public in doing that work?

- What, specifically, you need to get from the public and what you need to give them to get that?

- Who it is that you need to involve in the information exchange at this stage?

Now the task is to identify how the information exchange can be accomplished with the identified people to get the information needed. At this point there may be one or several community involvement techniques that might be considered. For each installation, it will be the combination of program needs, program and community involvement constraints and opportunities, size and composition of the people involved, and the character of the information needed from the public that will determine how the community involvement program is carried out in this step.

If you needed to get information about local zoning laws, you would probably not hold a public meeting or put an insert in the local newspaper. You would more likely conduct one on one interview with local officials and legal experts in the community. But a public meeting might be very appropriate in gaining information about the extent of perceived noise problems, or in getting reactions of the community to proposed land use changes to mitigate noise problems. A newspaper insert might be an appropriate way to get broad background knowledge about the Environmental Noise Management Program disseminated in the community.

Bear in mind that community involvement in the Environmental Noise Management Program is not a one-shot thing. It is expected that the community involvement plan will include some public involvement action at most stages.

IDENTIFY WHEN THE INFORMATION EXCHANGE ACTIVITIES SHOULD TAKE PLACE.

In working with the public in community involvement, care must be taken to pick times for involvement activities that take into consideration the people' time schedules and needs, as well as those of the presenters. Daytime meetings may exclude citizens with 9-5 jobs, or with child care responsibilities. On the other hand, daytime meetings may make it possible for a parent to attend who might have to be at home after school hours. In an industrial community, night shift workers sleep during the day and have their time to participate in an involvement activity skewed to that pattern of work and sleep.

In some communities, one night each week might be the time that many in town attend the high school football or basketball game, or the church's evening activities. A major event on television can result in an empty meeting hall if the activity is scheduled at the same time. Planting and harvesting season, or the opening days of fishing or hunting season, can be poor times to schedule activities that require public attendance for success. During times of identified conflict between other community activities and an involvement activity, it may be better to design more one-on-one processes for community involvement.

Some important community involvement events, dealing with issues of widespread public interest, may have to be scheduled for several different dates and times to provide opportunity for all interested parties and stakeholders to become involved in the Environmental Noise Management Program.

IDENTIFY THE PLACE WHERE THE COMMUNITY INVOLVEMENT INFORMATION EXCHANGE CAN TAKE PLACE.

Community involvement activities must be convenient in location as well as in time, for

those you expect to be involved. There may be an ideal physical facility for a large public meeting, or for a small committee meeting on the military installation. But if the public is not familiar with the layout of the installation, or if security regulations make access a complicated process, you might be better off using the facilities at a public building in the community such as a library, school or town hall. In some rural communities, the church meeting hall may be a more "comfortable" place to meet (as well as convenient to that community), than a meeting held at the Federal Building or City Hall. A series of living room or front porch meetings with small groups may be more attractive (and net more information exchange) to some community residents, than a larger meeting.

On-site activities may be very valuable as a means of getting information to the public, but consideration must be given to the physical capabilities of those invited, and to the planning of rest stops and time requirements. The care taken in planning the details of where community involvement might occur can help to improve and maintain relationships between the military and the public, and increase public acceptance and satisfaction with the Environmental Noise Management Program.

6.5 AGREEMENTS.

The installation should document the community involvement actions taken to reach or attempt to reach agreements between the installation and the local governments on matters affecting the Environmental Noise Management Program.

APPENDIX A

DESCRIPTION OF THE NOISE ENVIRONMENT, NOISE EVALUATORS AND NOISE CONTOURING PROCEDURES

A.1 INTRODUCTION.

Noise is defined as unwanted sound. Sound is the variation of air pressure about a mean (atmospheric) pressure. These changes in the atmospheric pressure [100,000 Pascals (14.7 pounds per square inch) (psi)] vary from approximately 0.0006 Pascals for a whisper at 2 meters to 1,000 Pascals for firing an M16 rifle at the firer's ear. Because of this large range of sound pressure and the fact that the human ear responds more closely to a logarithmic scale rather than a linear scale, sound pressure level is defined as 20 times the common logarithm of the ratio of the sound pressure to the reference pressure (0.00002 Pascal). The sound pressure level is measured in decibels (dB). For example, if the sound pressure doubles from 0.2 to 0.4 Pascals, the level increases by 6 dB from 80 to 86 dB.

A characteristic of environmental noise is that it is not steady, but varies in amplitude from one moment to the next. To account for these variations in the sound pressure level with time, and to assess environmental noise in a consistent and practical manner, a statistical approach has been used to reduce the time-varying levels to single numbers. For Federal agencies, the currently accepted single-number evaluators are the equivalent sound level (LEQ) and the day-night level (DNL). The predominant rating scale now in use in California for land use compatibility assessment is the Community Noise Equivalent Level (CNEL).

An essential concept in understanding environmental noise problems is the noise source, path and receiver relationship. Noise emanates from a source, travels along a path, and is perceived by the receiver. The end effect of noise on the receiver can be considered the focal point of the entire system.

Before a noise problem can be resolved, however, the nature and intensity of the noise must be quantified. Because of the different types of noise, e.g., fixed- and rotary-wing aircraft flyovers, ground run-up, and explosive detonations, there are differences in the way the sound levels are measured.

In environmental noise, the sound pressure level is usually measured using one of the frequency networks of the sound level meter. Since the human ear is more sensitive to sounds of 1,000 Hertz and above than sounds of 125 Hertz and below, it is appropriate to apply a weighting function to the noise spectrum to approximate the response of the

human ear. The A-weighting frequency network of the sound level meter de-emphasizes the lower frequency portion of the noise spectrum to approximate the human ear's response to the noise. This A-weighting frequency response is specified by an American National Standards Institute (ANSI) standard (ANSI 1983). In a wide variety of published studies, the A-weighting of the frequency content of the noise signal has been found to have an excellent correlation with the human subjective judgment of annoyance of the noise. The sound pressure levels measured using the A-weighting network are expressed as dBA.

To assess the additional annoyance caused by low frequency vibration of structures, the C-weighting network is used to evaluate the impulsive noise from all weapons larger than small arms. This weighting is also specified by the standard. The sound pressure levels measured using the C-weighting network are expressed as dBC.

A.2 HISTORY OF NOISE EVALUATORS.

Before the mid 1970's, every organization had its own set of preferred environmental noise evaluators. This resulted in a wide variety of evaluators. Since each evaluator was developed for a specific purpose, a noise environment measured with one evaluator could not be compared with an environment measured using another evaluator.

In carrying out its responsibilities under the Noise Control Act of 1972 (PL 92-574 1972), the U.S. Environmental Protection Agency (EPA) recommended the adoption of a single environmental noise evaluator, the LEQ and its 24-hour version, DNL. The Department of Defense, along with most other U.S. Government agencies followed the EPA recommendation. The DNL is the most widely accepted descriptor for environmental noise (FAA 1990) because of the following characteristics:

- The DNL is a measurable quantity.
- The DNL is simple to understand and use by planners and the public who are not familiar with acoustics or acoustical theory.
- The DNL provides a simple method to compare the effectiveness of alternative scenarios.
- The DNL is a "figure of merit" for noise impacts which is based on communities' reactions to environmental noise.
- The DNL is the best measure of noise exposure to identify significant impacts on the quality of the human environment.

- By Federal interagency agreement, the DNL is the best descriptor of all noise sources for land use compatibility planning.

- The DNL is the only metric with substantial body of scientific survey data on the reactions of people to noise.

In recommending the DNL, the EPA noted that most noise environments are characterized by repetitive behavior from day to day, with some variation imposed by differences between weekday and weekend activity, as well as seasonal variation. To account for these variations, an annual average is used.

Since annoyance is caused by long-term dissatisfaction with the noise environment, the annual average is an excellent predictor of the average community annoyance when there is not a large variation in the day to day or season to season DNL. The annual DNL is not a good predictor of noise complaints, since complaints represent the person's immediate dissatisfaction with the noise environment.

Currently, there are no guidelines for judging the land use compatibility for single noise events. Although much of the early work on annoyance was done on single events, each study was designed differently, and the results cannot be combined in a systematic fashion to form a statistically-valid sample. Most of these studies were either done inside a laboratory or, if done outdoors, in controlled settings. Only recently has equipment become available which would allow subjects to register their annoyance if single events are experienced during their routine activities. There is not enough of this information available to support setting standards on single events.

For impulsive noise, the Department of the Army uses the C-weighted DNL. The use of C-weighting is based on the findings of the National Academy of Sciences Committee on Hearing, Bioacoustics and Biomechanics (CHABA) (CHABA 1981). Studies have been performed by the U.S. Army Construction Engineering Research Laboratory (USACERL) (U.S. Army 1984) to define the average annoyance as a function of the C-weighted DNL. The ANSI (ANSI 1986) has endorsed this method for predicting the annoyance caused by impulsive noise.

Research with real explosions, small arms fire and truck noise Schomer (1994) confirms what Luz and Lewis (1979) previously found. Annoyance from impulsive noise does not increase at the same rate as annoyance from continuous noise. It increases twice as fast. That is, if an increase in the continuous noise level causes the annoyance to double, the same increase in the impulsive noise level will cause the annoyance to increase fourfold. At a sound exposure level (SEL) of 103 decibels (dB) the annoyance from continuous and impulsive noise is equal. ANSI has, in fact, recommended a methodology to adjust the calculation of CDNL to incorporate the accentuated loudness function associated with

weapons noise (ANSI, 1996). However, the collective experience of experts at CERL and CHPPM has shown the correction to be extremely sensitive to assumptions about the highest events in a statistical distribution of blast events. For this reason, the newer ANSI adjustment has not been used in the modeling of blast noise contours contained in the current IENMP.

A.3 LEQ/DNL/CNEL NOISE EVALUATORS.

The LEQ is defined as the equivalent steady state sound level which, in a stated period of time, would contain the same acoustic energy as the time-varying sound during the same period. The LEQ is an energy average. The energy average puts more emphasis on the higher sound pressure levels than the arithmetic average. The LEQ is usually computed for a 1-minute, 10-minute, 30-minute, 1-hour, 8-hour or 24-hour segment of environmental noise.

To assess the added annoyance of the environmental noise during the nighttime hours (2200 - 0700 hours), the DNL is used. The DNL is the 24-hour LEQ, with a 10 dB penalty added to the nighttime levels.

By using the LEQ and DNL, the three important determinants of noise annoyance can be described by using a single number. The three determinants are the intensity of the noise event, the duration of the noise event, and the number of times the noise event takes place. Numerous laboratory and field studies have confirmed that the tradeoff between intensity, duration and number is adequately described by averaging the total acoustical energy.

A.4 NOISE CONTOURS.

Noise contours for all noise sources are generated using the A- or C-weighted DNL. The contours are computed by averaging over the time period of interest, the acoustical energy from the operations of the set of noise sources of interest. The averaging period is usually a busy day, a training cycle, or a year. The contours, representing the boundaries between the noise zones, are constructed by connecting points of equal acoustical energy. For example, the contours for an airfield are computed by averaging at many points the acoustical energy arriving at these points from aircraft operations. A 10 dB penalty is

added to all nighttime operations. The contours for the airfield are constructed by connecting all points having a total acoustical energy equal to 65 dBA and connecting all points equal to 75 dBA.

A.4.1 IMPULSIVE NOISE.

The noise simulation program used to assess heavy weapons noise is BNOISE2. This model is an upgrade of MicroBNOISE (U.S. Army 1986).

BNOISE2 models the noise from the muzzle blast, the explosive detonation at impact, and the bow shock caused by the round going down range. The effects of terrain on the sound propagation are also included.

The BNOISEs program requires operational data concerning type of weapons fired from each range or firing point including demolitions, the number and type of rounds fired from each weapon, the location of targets for each range or firing point and the amount of propellant used to reach the target. Existing records on range utilization along with reasonable assumptions are used as BNOISE2 inputs.

A.4.2 AIRCRAFT NOISE.

The noise contours for aircraft activity are generated using the NOISEMAP 6.5 computer program. This program was developed for the US Air Force by Wyle Laboratories (U.S. Air Force 1990a). The required inputs to the program are the location of the flight tracks and the number of each type of aircraft using each flight track. The BASEOPS program (U.S. Air Force 1990b) is used to enter these data into the NOISEMAP input file. The NMPLOT program is used to plot the contours and to transfer the contour points to a GIS data layer.

The noise zones for the Nap of the Earth (NOE) routes are generated using the HELOSLICE computer program. The HELOSLICE is a simplified version of the NOISEMAP computer program. It was developed to predict the noise from operations at remote landing areas and from nap of the earth routes. The required inputs to this model include the number and type of aircraft using each area and the altitude of the aircraft at the point of interest.

The noise contours for the corridors by low-flying subsonic jet aircraft are generated using ROUTEMAP (U.S. Air Force 1988). The ROUTEMAP is a model developed for the U.S. Air Force by Wyle Laboratories used for predicting

noise exposure from aircraft operations on military training routes. The inputs to the model are the altitude, power setting, speed and number of operations by aircraft type for a one month period.

The ROUTEMAP model computes and plots the equivalent sound level (LEQ), the A-weighted day-night level (ADNL), the onset rate-adjusted monthly day-

night level (DNMRL), and the probability of high annoyance. These levels are computed for distances perpendicular to the corridor.

A.4.3 SMALL ARMS NOISE.

Because the small arms ranges at Fort McCoy are far from the boundary, no small arms range noise contours have been included in the current IENMP. If an occasion would arise in which a small arms range had to be located within 500 meters of the boundary, small arms noise contours would be appropriate. Small arms noise contours can be generated using the Small Arms Range Noise Assessment Model (SARNAM). It incorporates the latest available information on weapons noise source models (including directivity and spectrum), sound propagation, effects of noise mitigation and safety structures (walls, berms, ricochet barriers), and community response protocols for small arms noise. SARNAM uses a more suitable noise metric than has been previously used for small arms in the US. It includes an extensive selection of weapons in the source library, can handle multiple ranges of various types, and is designed to maximize user productivity. The graphical output shows noise contours and range boundaries and can also display installation features.

A.4.4 SINGLE EVENTS.

The noise level from a single event, such as artillery firings or explosive detonations, is useful to predict the annoyance and potential complaints caused by these events. The single event levels from the detonations are predicted using a module of BNOISE2, “One-Shot.”. This module is used to predict the expected mean linear peak sound level and the distribution of the levels about this mean for the proposed detonation weights and selected receiver locations.

“One Shot” incorporates an extensive measurement project by the U.S. Army Construction Engineering Research Laboratory (USACERL) at Fort Leonard Wood (U.S. Army 1976) and a statistical analysis of these measurements first demonstrated by Luz (1985). These measurements of 5 pound charges are corrected for the different charge weights (U.S. Army 1988d) with the relationship used by CERL in their linear peak sound level model. The accuracy of an earlier
version of this module for large detonations, SHOT, was checked with the measurements taken at Sierra Army Depot (U.S. Army 1988c and U.S. Army 1989). For the 29 measurements taken at Sierra, the mean level predicted by the SHOT model underpredicted the measured levels by an average of 1.4 decibels.

The effect of the topography can also included be modeled.. The topography

model was derived from our monitoring at Forts Knox and Indiantown Gap (Raspet and Lewis, 1986). This model was verified with the results of extensive monitoring at Picatinny Arsenal (U.S. Army 1991) and Navajo Depot Activity (U.S. Army 1992).

A.5 NOISE LEVEL REDUCTION.

The Department of Defense has published two guides on reducing noise through architectural mitigation. The first, Guidelines for the Sound Insulation of Residences Exposed to Aircraft Operations (Wyle, 1989), was jointly funded by the Naval Facilities Engineering Command and the Federal Aviation Administration. This document describes the options for quieting interior rooms from aircraft noise for 26 different types of residential construction. The second, Expedient Methods for Rattle-Proofing Certain Housing Components (Schomer et. al. 1987) was prepared by the Army Construction Engineering Research Laboratory. This report is more limited in its scope. Rather than being a guide on how to reduce the transmission of explosive noise heard inside a house, it analyzes several different building elements to identify individual components contributing to rattle. Eliminating rattle is important because people exposed to the sound of large guns tend to complain about the rattling rather than the sound. Some of the recommendations for eliminating rattle have been listed in Section 4.11 in the main body of this IENMP.

APPENDIX B

DISCLOSURES IN REAL PROPERTY TRANSACTIONS – WISCONSIN

In some States, it is possible to use real estate disclosure law to ensure that the seller of a residential property inform a buyer when outdoor noise levels interfere with the use or enjoyment of the property. As reproduced below, Wisconsin has a Real Estate Condition Report, and this report obliges a seller to inform the buyer about various adverse environmental conditions such as radon, radium in water supplies, lead in paint, lead in soil, lead in water supplies or the plumbing system, asbestos, potentially hazardous or toxic substances on the premises or unsafe concentrated due to storage of hazardous or toxic substances on neighboring properties. However, the report does not specifically mention unhealthy or annoying levels of noise. In theory, it might be possible to require a noise disclosure under Question C.27, "I am aware of other defects affecting the property." However, without the legislature having expressed its intent to include noise exposures under that provision, the use of Question C.27 to disclose high noise levels is unlikely.

Form No. 907-A **Real Estate Condition Report** (Detailed)
For Sale By Owner Madison
Wis. Stats. 709.02 (11-1-96)
Madison, **Wisconsin**
REAL ESTATE CONDITION REPORT
THIS CONDITION REPORT CONCERNS THE REAL PROPERTY LOCATED AT
IN THE
OF
,COUNTY
OF
,STATE OF **WISCONSIN**. THIS REPORT IS A DISCLOSURE OF THE CONDITION OF THAT
PROPERTY AS OF
,
IN COMPLIANCE WITH SECTION 709.02 OF THE **WISCONSIN** STATUTES. IT IS NOT A WARRANTY OF ANY KIND BY THE OWNER OR ANY AGENTS REPRESENTING ANY PRINCIPAL IN THIS TRANSACTION AND IS NOT A SUBSTITUTE FOR ANY INSPECTIONS OR WARRANTIES THAT THE PRINCIPALS MAY WISH TO OBTAIN.

OWNER'S INFORMATION

B.1.
In this form, “am aware” means to have notice or knowledge. In this form, “defect” means a condition that would have a significant adverse effect on the value of the property; that would significantly impair the health or safety of future occupants of the property; or that if not repaired, removed or replaced would significantly shorten or adversely affect the expected normal life of the premises.

B.2.
The owner discloses the following information with the knowledge that even though this is not a warranty, prospective buyers may rely on this information in deciding whether and on what terms to purchase the property. The owner hereby authorizes any agent representing any principal in this transaction to provide a copy of this statement, and to disclose any information in the statement, to any person in connection with any actual or anticipated sale of the property.

B.3.
The owner represents that to the best of his or her knowledge the responses to the following statements have been accurately noted as “yes”, “no” or “not applicable’’ to the property being sold. If the owner responds to any statement with `’yes”, the owner shall provide, inthe additional information area of this form, an explanation of the reason why the response to the statement is “yes”.

B.4.
If the transfer is of a condominium unit, the property to which this form applies is the condominium unit, the common elements of the condominium and any limited common elements that may be used only by the owner of the condominium unit being transferred.

Yes No N/A Report*
STATEMENTS

C.1.
I am aware of defects in the roof.

C.2.
I am aware of defects in the electricalsystem.

C.3.
I am aware of defects in part of the plumbing system (including the water heater, water softener and swimming pool) that is included in the sale.

C.4.
I am aware of defects in the heating and air conditioning system (including the air filters and humidifiers).

C.5.
I am aware of defects in the well, including unsafe well water.

C.6.
I am aware that this property is served by a joint well.

C.7.
I am aware of defects in the septic system or other sanitary disposal system.

C.8.
I am aware of underground or aboveground fuel storage tanks on or previously located on the property. (If "yes'', the owner, by law, may have to register the tanks with the Department of Commerce at P.O. Box 7970, Madison, **Wisconsin** 53707, whether the tanks are in use or not. Regulations of the Department of Commerce may require the closure or removal of unused tanks.).

C.9.
I am aware of an "LP'' tank on the property. (If ``yes", specify in the additional information space whether or not the owner of the property either owns or leases the tank).

C.10.
I am aware of defects in the basement or foundation (including cracks, seepage and bulges).

C.11.
I am aware that the property is located in a floodplain, wetland or shoreland zoning area.

C.12.
I am aware of defects in the structure of the property.

C.13.
I am aware of defects in mechanical equipment included in the sale either as fixtures or personal property.

C.14.
I am aware of boundary or lot line disputes, encroachments or encumbrances (including a joint driveway).

C.15.
I am aware of a defect caused by unsafe concentrations of, or unsafe conditions relating to, radon, radium in water supplies, lead in paint, lead in soil, lead in water supplies or plumbing system, or other potentially hazardous or toxic substances on the premises.

C.16.
I am aware of the presence of asbestos or asbestos-containing materials on the premises.

C.17.
I am aware of a defect caused by unsafe concentrations of, unsafe conditions relating to, or the storage of, hazardous or toxic substances on neighboring properties.

C.18.
I am aware of current or previous termite, powder-post beetle or carpenter ant infestations.

C.19.
I am aware of defects in a wood burning stove or fireplace or of defects caused by a fire in a stove or fireplace or elsewhere on the property.

C.20.
I am aware either that remodeling affecting the property's structure or mechanical systems was done or that additions to this property were made during my period of ownership without the required permits.

See
Expert's
(STREET ADDRESS)
(CITY) (VILLAGE) (TOWN)
(MONTH)
(DAY)
(YEAR)
THE FOLLOWING OBSERVATIONS (IN BOXES) ARE MADE TO
ASSIST YOU IN RESPOINDING TO THESE QUESTIONS. THESE
OBSERVATIONS ARE NOT PART OF THE STATE MANDATED FORM.

ROOF DEFECTS: include, without limitation, rot; eaves, gutters,
or shingle defects; leaks; ice or snow buildup.

ELECTRICAL SYSTEM DEFECTS: include, without limitation, all household systems, also doorbells, intercom, sound and/or video systems; wiring contrary to code.

PLUMBING SYSTEM DEFECTS: include, without limitation, all household systems, inadequate pressure or quality, leaks, also sprinklers, hot tub; repairs contrary to code.

HVAC SYSTEM DEFECTS: include, without limitation, all household systems, inadequate or excessive temperatures; also fans, events, solar collectors, and air filtration systems.

WELL DEFECTS: include, without limitation, abandoned or unused wells, contrary to code, periodic insufficient supply; requiring excessive maintenance.

SEPTIC DEFECTS: include, without limitation, abandoned or unused tanks, contrary to code; requiring excessive maintenance; ponding (interior or exterior); overflows.

BASEMENT DEFECTS: include, without limitation, moisture or dampness; defective drain systems; bulging or walls not plumb.

STRUCTURAL DEFECTS: include, without limitation, any deterioration, flaws, or defect in walls, ceiling, floors, partitions, shutters, foundation; also driveways, sidewalks, patio; decks, fences, window inoperable, cracked or thermopane seal broken, wood rotting.

MECHANICAL DEFECTS: include, without limitation, all appliances, stove, oven, range, microwave, refrigeration, disposal, vent fans, washer, dryer, water heater, water softener, trash compactor, garage door openers, central vacuum, incinerator, sump pump, window air conditioners, humidifier, pool & equipment, antenna, cable system, security system, and/or smoke alarms. These include, without limitation, fireplace, stove, and chimney.

Yes No N/A Report*

C.21.
I am aware of federal, state, or local regulations requiring repairs, alterations or corrections of an existing condition.

C.22.
I have received notice of property tax increases, other than normal annual increases, or am aware of pending property reassessments.

C.23.
I am aware that remodeling that may increase the property's assessed value was done.

C.24.
I am aware of proposed or pending special assessments.

C.25.
I am aware of the proposed construction of a public project that may affect the use of the property.

C.26.
I am aware of subdivision homeowners' associations, common areas co-owned with others,

zoning violations or nonconforming uses, rights-of-way, easements, or another use of a part of the property by nonowners, other than recorded utility easements.

C.27.
I am aware of other defects affecting the property.

ADDITIONAL INFORMATION

D.1.
I am aware that a structure on the property is designated as an historic building or that part of the property is in an historic district.

D.2.
The owner has lived on the property for
years.

D.3.
Explanation of "yes" responses. (See B.3.)

See
Expert's

OTHER DEFECTS: include, without limitation, flooding, garage defects, infestations by insects or other pests, missing storms & screen; improper drainage; flooding; soil or subsoil problems; unusual odors, sound or visual nuisances; deed restrictions; solar or subdivision restrictions.

It is understood that the observations in the boxes were supplemental information only and the defects and conditions referenced in the questions were not limited to only those examples and observations.

OWNER'S CERTIFICATION

E.
The owner certifies that the information in this report is true and correct to the best of the owner's knowledge as of the date on which the owner signs this report.

NOTE: **Wisconsin** Statute 709.035 requires owners who, prior to acceptance, obtain information

which would change a response on this report, to submit a new report or an amended report to the prospective buyer.

Owner
Date
Owner
Date
Owner
Date
Owner
Date

CERTIFICATION BY PERSON SUPPLYING INFORMATION

F.
A person other than the owner certifies that he or she has supplied information on which the owner relied for this report and that information is true and correct to the best of that person's knowledge as of the date on which the person signs this report.

Person
Items
Date
Person
Items
Date
Person
Items
Date
Person
Items
Date

NOTICE REGARDING ADVICE OR INSPECTIONS

G.
THE PROSPECTIVE BUYER AND THE OWNER MAY WISH TO OBTAIN PROFESSIONAL ADVICE, OR INSPECTIONS OF THE PROPERTY AND TO PROVIDE FOR APPROPRIATE PROVISIONS IN A CONTRACT BETWEEN THEM WITH RESPECT TO ANY ADVICE, INSPECTIONS, DEFECTS OR WARRANTIES.

BUYER'S ACKNOWLEDGMENT

H.1.
THE PROSPECTIVE BUYER ACKNOWLEDGES THAT TECHNICAL KNOWLEDGE SUCH AS THAT ACQUIRED BY PROFESSIONAL INSPECTORS MAY BE REQUIRED TO DETECT CERTAIN DEFECTS SUCH AS THE PRESENCE OF ASBESTOS, BUILDING CODE VIOLATIONS AND FLOODPLAIN STATUS.

H.2.
I ACKNOWLEDGE RECEIPT OF A COPY OF THIS STATEMENT.
Prospective Buyer
Date
Prospective Buyer
Date
Prospective Buyer
Date
Prospective Buyer
Date
Except as noted below, there have been no significant changes in the property from these conditions as existed and were stated on
, .
Explain:
If conditions have changed, Buyer to initial here to acknowledge receipt of modified form.
*NOTE: All information appearing in italics in this **REAL ESTATE CONDITION REPORT** is purely of a supplemental nature and is not part of the **REAL ESTATECONDITION REPORT** required pursuant to Section 709.03 of the **Wisconsin** Statutes.Form pursuant to Wis. Stats. 709.02; observations and additional information drafted by Attorney Alan H. Deutch.
BELOW TO BE COMPLETED AT CLOSING
(Seller) Upon Closing of Property.
Date
(Seller) Upon Closing of Property.
Date

APPENDIX C

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APPENDIX D

INFORMATION ON THE RESPONSE OF ANIMALS TO LOW LEVEL FLIGHTS BY HELICOPTERS

Three government reports were used to prepare this Appendix on the response of animals to low level flights. The first was the Department of Interior's Report on Effects of Aircraft Overflights on the National Park System, which was presented to Congress in July 1995 (NPS, 1995, Chapter 5). The second was a literature review on the effects of military noise on wildlife published by the Army Construction Engineering Research Laboratory (Larkin et al. (1996). The last was a report on the ecological risk of low-altitude overflights published by the Oak Ridge National Laboratory (Efroymson et al. 2000).

Of these three reports, the NPS report is most conservative. On p. 120, the report states, "Comparisons of how animals respond to helicopters versus other aircraft types have shown that animals respond more strongly to helicopters." On p. 119, the NPS report states, "It is unlikely that one overflight altitude exists that is sufficient for avoiding disturbance to all animals while not necessarily imposing undue restrictions on pilots." The review of Larkin et. al., (1996) discusses studies in which fixed wing aircraft were more disturbing as well as studies in which rotary wing aircraft were more disturbing. Efroymson et al. (2000) blur the distinction by developing graphs relating disturbance to distance from any type of aircraft.

Of the three reports, Larkin et al. (1996) contains the most detailed discussion of studies of animal response to helicopter noise. This discussion is reproduced below verbatim (pp. 43 to 50)

One of the best documented instances of wildlife response to helicopters occurs in a sea bird, Brünnich's Guillemot (Thick-billed Murre), which incubates the eggs by placing them on the top surface of the feet. If the incubating parent is disturbed while in this position, the eggs are extremely vulnerable to being broken. Fjeld et. al. (1988) summarize prior studies of seabirds, especially Brünnich's Guillemot, reportedly suffering brood mortality from flushing off the nest in response to fixed-wing aircraft and helicopters. In colonies where aircraft overflights are frequent, guillemots do not usually react to them, which the authors attribute to habituation. In ambitious experiments, the authors arranged experimental overflights with a Bell 212 helicopter and playback experiments with unaltered and with bass-and treble-heavy helicopter noise. None of the 89 breeding Brünnich's Guillemots lost eggs as a result of the experimental overflights; however the authors speculate that the late stage of the breeding season and small colony size may have reduced the birds' reactions compared to other situations. Claimed reactions to recorded frequencies as low as 24 to 48 Hz in the helicopter sounds were not supported by adequate quantitative spectrographic data. The authors note the technical difficulty of obtaining high-fidelity reproductions of the noise of helicopters. Nevertheless, the auditory, as opposed to visual component of the helicopter caused reactions from the guillemots. The birds sometimes

responded to the helicopter at a distance of 6 km and always by a distance of 2.5 km. Reactions were correlated primarily with the sound levels from the helicopter, only secondarily with its distance. No indication of habituation to the helicopter was seen in those infrequently-repeated experiments.

Follow-up work with Brünnich's Guillemot and a somewhat smaller helicopter (AS 350 Ecureuil) was performed on a large and remote colony of 90,000 birds (Olsson and Gabrielsen 1990). Results were similar to the earlier study (Fjeld et al. 1988) except that sound could not be specifically implicated, partly because spectra and SPLs were not measured in these followup experiments. Eggs or chicks were not lost as a result of the flybys, according to the observations.

Temple (1993) found that prehatching reproduction in penned Black Ducks was largely unaffected by aircraft disturbance, but survival of chicks was lower in a noisy than a control area. Only one experimental and one control area were used and no determination could be made whether the various military helicopters and fixed wing aircraft to which the birds were exposed had differing effects. This thesis also reviews other studies of aircraft noise and waterfowl.

Other studies report on the effects of aircraft noise/overflights on reproduction in various birds. Gollop et al. (1974a) concluded that helicopters and fixed wing aircraft did not impact reproduction in Glaucous Gulls. Henson and Grant (1991) observed Trumpeter Swans subjected to aircraft pass-bys. The birds reacted to both fixed-wing and rotary-wing aircraft (19 of 21 trials) and the authors noted potential effects on reproductive success. No noise measurements were taken and the kind of helicopter was not reported. Platt (1975, 1977) observed small numbers of Gyrfalcons and other arctic raptors during experimental overflights by small helicopters. He concluded that more overt responses were elicited by helicopters at 300 m above ground level (AGL) than at 150 m AGL and that immediate behavioral responses (fleeing, etc) did not carry over into immediate effects on reproductive success. Delayed effects on nesting success in these studies were discussed earlier. In Florida, Sandhill Cranes "remained on their eggs in 82 percent (N=250) of the cases in which [a helicopter of undocumented model] flow as low as 40 m above them" during nest surveys.

Molting arctic geese in a remote area reacted strongly to noise of Bell 206 and 212 helicopters (Mosbech and Glahder 1991). The authors state that the larger 212 helicopter caused reactions at great distances (about 9 km), where the helicopters were not visible. Pink-footed Geese "probably did not get enough food" because of disruptions to feeding caused by the helicopters.

Schroeder et al. (1992) surveyed leks of prairie chickens with a Bell 47 Soloy helicopter at 50 to 100 m AGL. Although no description of responses to the helicopter is provided, "Leks were easiest to locate when birds were flushed and flying birds were silhouetted against the horizon, rather than directly below" (p. 111). Watson (1993) reviews Bald Eagle responses to

helicopters and conducted nest surveys of this species "from a 3-seat Hiller/Soloy UH-12E and a 4-seat Bell 206-BIII," avoiding passing directly over the nests. Distances from the nests and eagles (N=270 perched birds) were carefully noted when responses of various types occurred. Unfortunately, the brief tabular presentation of distances is insufficient to interpret the interesting result that disturbance rates of adult eagles were nonmonotonically related to distance approached in the helicopters. The author attributes the effect to the tendency of eagles perched near the nest to remain perched except when helicopters approach very closely. No breakdown of results by model of helicopter is presented and no noise levels are reported.

Studies prior to 1990 on responses (or lack of response) of raptors to helicopters are reviewed and tabulated in Awbrey and Bowles (1990). Helicopters elected more responses and a higher proportion of flight responses, as opposed to merely alerting, than most other simuli. Specifically, Andersen et al. (1989) experimentally approached 35 nests of Red-tailed Hawks with an Army UH-1 Huey (the military version of a Bell Model 205). Overall, 40 percent of birds flushed, all at short line-of-sight distances (mean for different groups about 40 to 110 m).

Beyer (1983) studied physiological and other reactions of pregnant dairy cows during experimental low-altitude helicopter overflights. Vigorous behavioral, heart rate, and glucocorticoid increases occurred in response to early overflights. The results are of interest because the cows did not injure themselves by running and there were no indications of reproductive problems.

Reindeer were once herded by helicopter in Russia, a practice discontinused because of "detrimental effects experienced by the reindeer" (Andreev, in Klein 1973). Controlled overflights of caribou by a Fairchild-Hiller 1100 helicopter (Klein, 1973) showed stronger responses to lower-height helicopters than higher ones (no statistical analyses are presented). The authors speculate about the behavioral mechanism(s) of this result (p. 17). Extensive experiments (N=1,000 overflights) permitted the authors to analyze helicopter height, ungulate group composition, sun position, wind, and other factors that modulated the response of these large ungulates to helicopters.

Lenarz (1974) studied reactions of bands of dall sheep, also in response to a Fairchild-Hiller 1100 helicopter, flying at about 100 to 150 m distance in mountainous terrain. Reactions were independent of whether the helicopter was above, even in height with, or below the sheep. Ewes with lambs reacted more strongly to the helicopter than rams or (effectively) sheep of unknown gender. Apparently the same sheep were used indeterminate numbers of times in the experiments and no evidence was obtained indicating whether the sheep reacted to auditory versus visual cues. MacArthur et al.(1979) found that bighorn sheep showed little change in heart rate in response to humans on foot, vehicles on a road, low-flying fixed wing aircraft, or helicopters 0.5 to 1.5 km distant, but one of the sheep exhibited increased heart rate 3.5 fold and begun to run when a Bell-206 helicopter flew directly overhead at 150 to 200 m AGL. (The temporal details of the onset of tachycardia and onset of running are not shown in the published

report.) Some persisting elevation in heart rate after the flyover was noted as the helicopter was audible (to the observers, extrapolated to the sheep), possibly suggesting some learned response to the noise after being subjected to the flyover. During recreational helicopter overflights at the Grand Canyon in Arizona, desert bighorn sheep decreased the time they spent foraging 17 percent but the magnitude of the effect and the interaction with the altitude of the sheep varied strongly according to season (Stockwell and Bateman 1987, Stockwell et al. 1991).

Miller and Gunn (1981) flew a Bell 206B helicopter over groups of Peary caribou, observing behavior of calves from the ground before, during, and after overflights. The authors do not report the height of the overflights nor any indication of whether sight, sound, or both played a part. Caribou calves played more during overflights than in control periods, which the authors attribute to increased "excitement" on the part of calves. The authors speculate about "stress" and play behavior in caribou.

Luz and Smith (1976) observed one herd of pronghorn that reacted to an Army OH-58A helicopter when the sound level (slow response setting on B & K Model 2209 SLM) was about 60 to 77 dBA, at a slant range of 150 m. No attempt was made to distinguish whether the pronghorn used visual cues, auditory cues, or both to detect the helicopter. The animals had little prior experience with helicopters.

Young (1994) studied responses of Mt Graham red squirrels, an endangered species in a formerly remote area, to helicopters and other sources of noise near areas of human construction activities. The squirrels reacted more to helicopters, bulldozers that came close, and people on foot than to bulldozers at a distance, blasting, and large nontracked vehicles. Noise levels were not quantified.

Many studies examined fixed-versus rotary-wing aircraft effects on wildlife. Usually distances and noise levels vary between the two types of aircraft. Helicopters usually elicit more vigorous behavioral responses and/or responses at greater distances than fixed-wing aircraft (Watson, 1993).

Ward and Stehn (1989) succinctly review responses of Black Brant to aircraft including helicopters and present results of an extensive study at a Brant stopover point at Izembeck Lagoon, Alaska. They studied responses by Pacific Black Brant and other geese to unplanned and experimental flyovers. Various eagles, helicopters, and fixed wing aircraft provided infrequent (1.1 per hr) unplanned flyovers. Brant both oriented the head and took flight in response to aircraft (fixed-wing and helicopters) at much greater distances (about double) than the distances to which they reacted to or fled from Bald Eagles (p. 104). A large Bell 205 and two smaller helicopters, Bell 206 and Hughes 500-D, were used in experimental flyovers. The large Bell 205 helicopter produced the highest proportion of responses of any aircraft. Helicopters showed no uniform trend of probability of response with height - the relationship was positive in some cases. Ward and Stehn (1989) attribute this phenomenon to wind induced

"shadow zones that reduce noise transmission of aircraft at low altitudes." These experiments took place largely over open water, so that terrain did not often obscure the helicopters from being seen by the settled geese.

Grubb and King (1991) found that, for a Bald Eagle population exposed regularly to fixed-wing aircraft but not to helicopters, helicopters elicited more response than did fixed-wing aircraft—an unsurprising result.

Snow geese flushed sooner in response to a helicopter (Bell 206 and Huhes 500) but flew farther in response to small fixed-wing aircraft (Davis and Wisely 1974). The bird had experience with both rotary-and fixed-wing aircraft; only 14 flocks were involved in the experimental (as opposed to ongoing) flights over the geese.

Kushaln (1979 compared short term responses of wading birds (mainly Ardeids) to a propeller-driven, fixed-wing aircraft and a Bell 47G-2 helicopter. Only two colonies were studied. Although data presented are insufficient to determine the degree to which different species were disturbed by the helicopter, it caused less disturbance than the fixed-wing aircraft. In all cases, birds that were disturbed and left their nests returned within 5 minutes. Possible previous experiences of these birds with helicopters is not mentioned.

Harrington and Veitch (1991) monitored locomotory and other behavior of caribou during and after military jet aircraft and helicopter overflights. The animals responded more strongly to the helicopter (shorter latency, longer and farther locomotion) than to the jets, although the rate of approach, the sequence of stimulus type (jet vs. helicopter), and the prior experience of the caribou with the two types of aircraft all differed, as well as their sounds. The authors discuss visual vs. auditory cues with respect to approaching jet and rotary-winged aircraft. For a caribou herd whose prior exposure to fixed-vs. rotary wing (small propeller airplanes vs. small Bell 206 helicopter) was not documented, different investigators report conflicting results on which type of aircraft produced stronger reactions from the animals (Calef et al. 1976, McCourt et al. 1974), although statistical analysis was lacking from these studies and the visual vs. auditory component of the disturbance was not investigated.

Brach (1983) and Stephan (1993) subjected game-farm mink to aircraft approaches when the mink could see the aircraft and when the aircraft was hidden from view. The results indicated that game-farm mink show little response when subjected to fixed-and rotary-winged ("BO 105") aircraft noise in the absence of visual cues; however, when that noise is coupled to a

visual stimulus, mink orient to the stimulus. Previous anecdotal reports of more severe reactions such as reproductive failure were not confirmed in these studies.

Gladwin et al. (1988a) provide very brief summaries of 47 anecdotal reports of effects of helicopters (or mixed helicopters and fixed-wing aircraft) at U.S. Fish and Wildlife Service

areas. Helicopters are reported to disturb wildlife, especially waterfowl, more than fixed-wing aircraft, although the proximity of the different types of aircraft to the wildlife and other factors are taken into account poorly, if at all. More research on effects of aircraft noise on wildlife was recommended.

Edwards et al. (1979) conducted brief observations of wildlife reacting to a Bell 47-G helicopter at Aransas National Wildlife Refuge. Species differences were noted and some species were considered by the authors to be intolerant of helicopter noise. More recently however, a nationwide survey of noise of military aircraft over national wildlife refuges has not yet been reported in enough depth to contribute to our understanding of military noise and wildlife (United States Fish and Wildlife Service 1994).

Guidelines for maintaining minimum slant distances have been reproduced from Efroymson et al. (2000) for raptors and ungulates (Table D.1, Figure D.1 and D.2). Based on an interview with a helicopter pilot with 30 years experience in herding elk, bison and cattle, the 400 meter rule shown for ungulates in Figure D.2 applies to domestic cattle as well (Miller, 2003). The only exception is spring cattle introduced into open plains for fattening. These cattle are "spooked" at greater distances.

Table D.1 Helicopter Distance and Sound pressure Thresholds for Effects on Raptors.

Species	Overflight	LOAEL	NOAEL	Response	Location	Reference
Red-tailed hawk (*Buteo jamaicensis)*	Single Army UH-1 flew directly at nests and passed within 30 m., 45-65 km/h, daytime	100 mean slant distance, 30-45 altitude	500m > slant distance, 100 m	9/17 (53%) flushed (not previously habituated to overflights)	Pinyon Canyon Maneuver Site in southeastern Colorado	Andersen et al, 1989
Red-tailed hawk (*Buteo jamaicensis)*	Single Army UH-1 flew directly at nests and passed within 30 m., 45-65 km/h, daytime	10 m mean slant distance, 30-45 m altitude	About 11 m slant distance	1/12 (8%) flushed (previously habituated to overflights)	Fort Carson Military Reservation in east Central Colorado	Andersen et al, 1989
Rough-legged hawk (*Buteo lagopus*)	Helicopter		150, 300 m slant distance	No flushing of two birds from nest	Unknown	Platt, 1977
Golden eagle (*Aquila cyrsaetos*)	Helicopter	150 m		½ birds flushed from next	Unknown	Platt, 1977
Bald eagle (*Haliaeetus leucocephalus*)	UH-1 and OH-58 helicopters, 35-55 km/hr	60-120 m altitude		43% of adults and 54% of subadults flushed	Fort Lewis, Washington	Stalmaster and Kaiser, 1997
Bald eagle (*Haliaeetus leucocephalus*	Sample of 25% military jets, 51% light planes, 24%	400 m slant distance	850 m slant distance	25% took flight; helicopters had highest response	Arizona and Michigan	Grubb and Bowerman, 1997

	helicopters					

Table D.1 Helicopter Distance and Sound pressure Thresholds for Effects on Raptors. (continued)

Species	Overflight	LOAEL	NOAEL	Response	Location	Reference
Bald eagle (*Haliaeetus leucocephalus*	Hiller/Soloy UH-12E or Bell 206-BIII	>120 m		93% flushed; % flushed birds independent of distance from <30 to >120 m	7-county region of Puget Sound, northwestern Washington	Watson, 1993
Gyrfalcon (*Falco rusticolus candicans*)	Bell 206 helicopter	1600 m		Flight of pre-egg laying birds from a single next, ¼ (25%) of overflights		Platt, 1977
Peregrine falcon (*Falco peregrinus*)	Helicopter		150-600 m slant distance	0/6 birds flew from nest	Unknown	Platt, 1977
Peregrine falcon (*Falco peregrinus*)	Bell 206 helicopter or Cessna 185	105 m slant distance		5/48 birds (10.4%) flushed from nest	Unknown	Windsor, 1977
Mexican spotted owl (*Strix occidentalist lucida*)	Sikorsky, HH-60G, Pave haw, and twin jet helicopters, 150-170 km/hr	61-105 m slant distance (effect observed at 89 m)	105 m slant distance, 104 dBO (92 dBA) SEL	5% flush frequency of owls	Sacramento Ranger Distrct of Lincoln National Forest, south-central New Mexico	Delaney et al, 1999
Turkey vulture (*Cathartes sp.*)	Bell 476 helicopter		31-310 m, 96 dBA	0/6 birds flushed	Unknown	Edwards et al, 1979

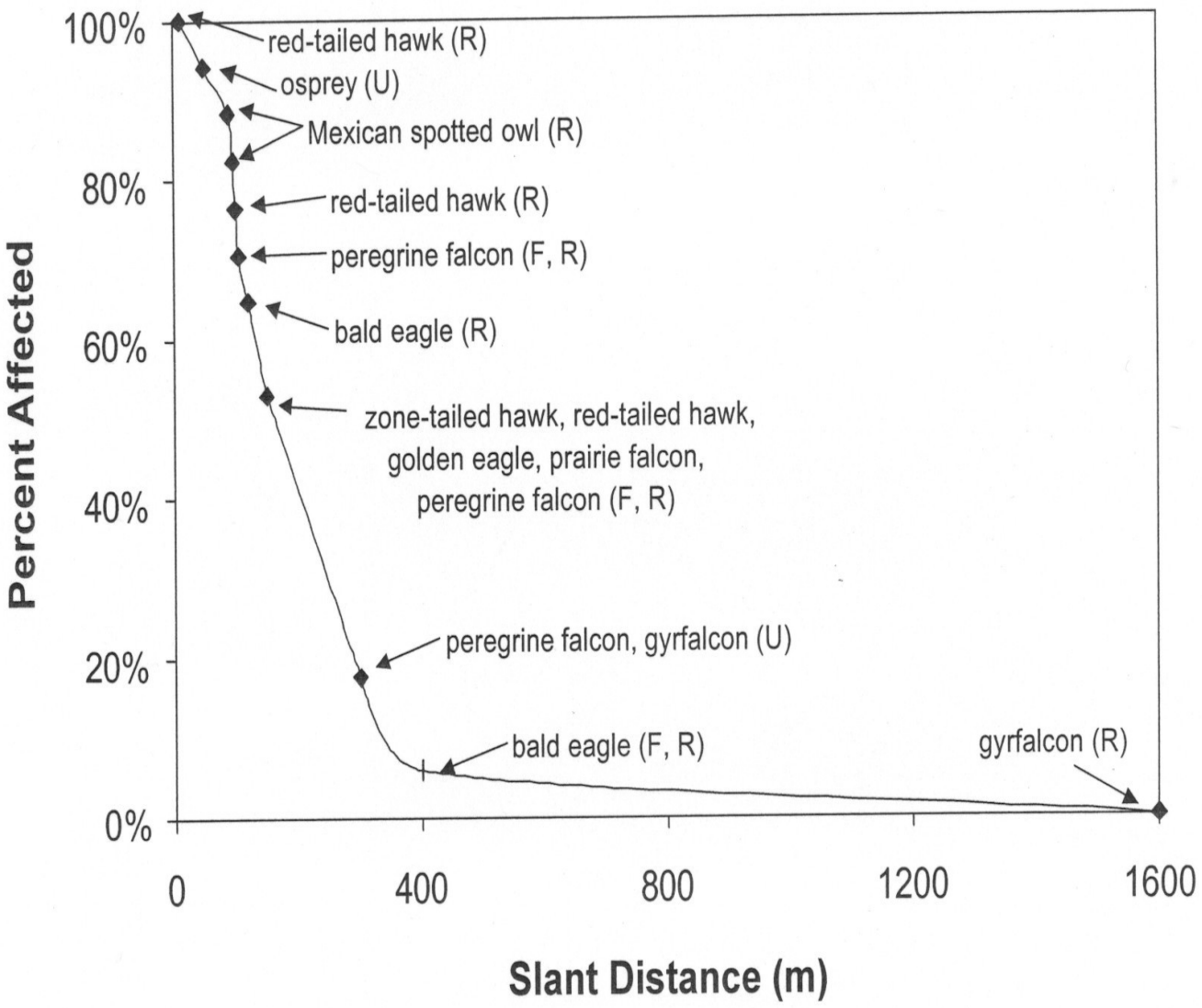

Figure D.1. Distribution of slant distance thresholds for behavioral effects on raptors from various aircraft as compiled by and reproduced from Efroymson et al. (2000). F, R and U indicate that effects are due to fixed-wing, rotary-wing and unknown aircraft respectively

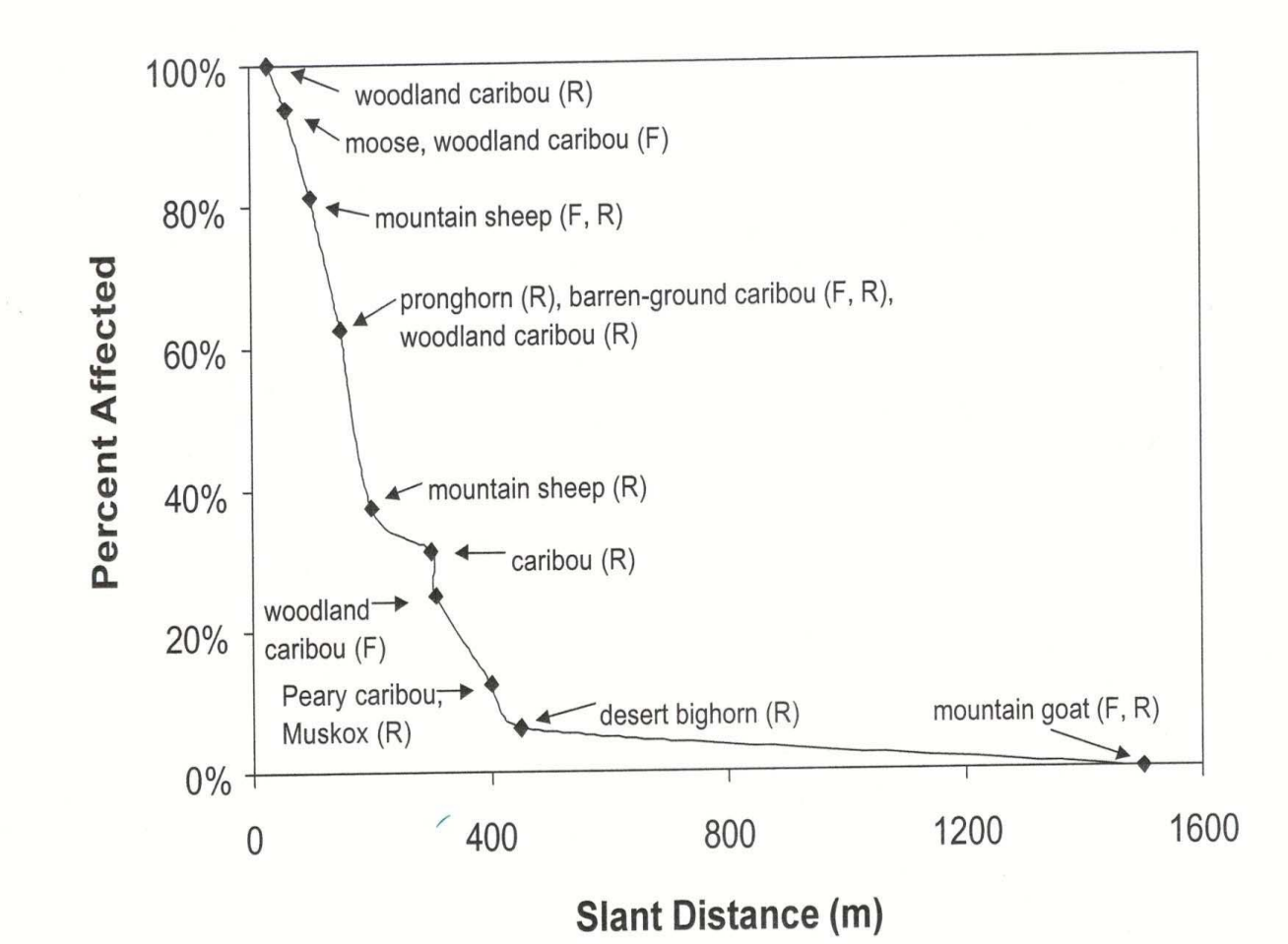

Figure D.2. Distribution of slant distance thresholds for behavioral effects on ungulates from various aircraft as compiled by and reproduced from Efroymson et al. (2000). F and R indicate that effects are due to fixed-wing, rotary-wing and unknown aircraft respectively

APPENDIX E

LAND USE PLANNING AND CONTROL TECHNIQUES

E.1 GENERAL.

Several different planning and land use control techniques are normally available to local governments to prevent noise intrusions. Controls that are generally most useful for achieving compatibility, zoning, easements and development rights, and land purchase are discussed in this appendix. Other controls such as building codes (noise insulation requirements), health and housing codes, programming of public capital improvements, and cooperation of financial institutions have either less or specialized applicability. The following list has been reproduced from a report issued by the Army Construction Engineering Research Laboratory (U.S. Army, 1988a)

E.1.1 ZONING.

The most common and useful land use control method is zoning. This method is an exercise of the police powers of state and local governments that designates the uses permitted on each parcel of land. It normally consists of a zoning ordinance that delineates the various use districts and includes a zoning map based on the land use element of the community's comprehensive general plan. At the same time, a zone is subject to change and must be monitored continually if it is to remain a viable compatibility tool.

E.1.1.1 USES OF ZONING. Zoning should be applied fairly and based on a comprehensive plan. Zoning ordinances implement provisions of the comprehensive plan. This plan must consider the total needs of the community along with specific needs of the installation. For example, to zone a parcel of land for industrial or warehouse usage simply because it lies within a noise impact area is not acceptable. Such an action could be considered "arbitrary, capricious, or unreasonable" and thus vulnerable in the event of judicial review. The plan must clearly demonstrate that there is a reasonable present or future need for such usage. Zoning can and should be used constructively to increase the value and productivity of land within the noise areas. Used within its limitations, zoning is the preferred method of controlling land use in noise-impacted areas.

E.1.1.2 LIMITATIONS OF ZONING. Zoning has several limitations that

must be considered when using it as a compatibility implementation tool. These limitations include:

Zoning is usually not retroactive. That is, changing a zone primarily for the purpose of prohibiting a use that already exists is normally not possible. However, if such zoning is accomplished, the use must be permitted to remain as a "nonconforming" element until the owner has had ample opportunity to recoup his/her investment.

Zoning is jurisdiction-limited. Installation impacts often span more than one zoning jurisdiction. In this case, zoning requires coordination of all involved jurisdictions. Zoning that implements, a compatibility plan will often be composed of existing and new zoning districts within each of the zoning jurisdictions covered by the plan. Each jurisdiction is likely to have a different base zoning ordinance with districts having different applicability for implementing the compatibility plan. Counties in many states do not have zoning authority; hence, land use control via zoning in these states stops at the municipal boundary.

Zoning is <u>not</u> permanent. In any jurisdiction, zoning can be changed by the current government body; it is not bound by prior zoning actions. Consequently, zoning that achieves compatibility is subject to continual pressure for change from both urban expansion and enterprises that might profit from such changes. When these changes are proposed, the environmental impacts may require assessment. Also, from time-to-time the entire zoning ordinance for a jurisdiction will be updated to accommodate increased growth or incorporate new land use concepts.

Cumulative zoning can permit incompatible development. Several communities still have "cumulative" type zoning districts that permit all "higher" uses (such as residential) in "lower" use districts (such as commercial or industrial), thus supporting development that may be incompatible. In these instances, it is necessary to prepare and adopt new or additional zoning districts of the "exclusionary" type that clearly specify the uses permitted and exclude all others.

Zoning Board of Adjustment actions granting variances to the zoning district or exceptions (e.g., schools or churches) written into the

zoning ordinance can also permit development that may be incompatible.

E.1.1.3 POSITIVE FEATURES OF ZONING. The zoning ordinance may be the most attractive land use control to prevent development around installations. First, zoning is the most effective control because, by law, it can prohibit specific developments. Second, this technique normally costs the installation nothing.

E.1.1.4 NEGATIVE FEATURES OF ZONING. The installation must rely on the municipality's governing body for proper zoning solutions. This may involve a political struggle beyond the installation's control. Also, the municipality must be wary of "taking land without just compensation," which is an issue often raised in zoning proceedings.

E.1.2 EASEMENTS.

Easements can be an effective and permanent form of land use control. In many instances, they may be better than zoning for the installation's compatibility issues. Easements are permanent, with the title held by the purchaser until sold or released, and work equally well within different jurisdictions. They are directly enforceable through civil courts and may often be acquired for a fraction of the cost of the land value. Another consideration is that the land is left free for full development with noise-compatible uses.

E.1.2.1 DEFINITION. An easement is a right of another to part of the total benefits of the real property owner. Ownership of property includes possession of a series of rights to the use of that property. Certain rights to the property are always retained by the state or the general public, i.e., police power, taxation, eminent domain, and escheat (right of the sovereign to own those properties not in the ownership of others). Other rights are retained by neighboring property owners (e.g., the flow of water across land). Rights of ownership, i.e., possession of all rights in the land except those retained by the state, general public, or neighbors, may be bought and sold separately. When property is acquired, usually all rights are purchased (i.e., in fee simple). However, it is possible to buy only selected rights that are actually needed. These rights can be acquired in the form of easements, with the other rights retained by the owner. There are many types of easements. They can be categorized as subsurface easements such as pipelines and underground utilities; surface easements, such as roads,

utilities, and access; and above-surface easements, such as air rights or navigation easements. The cost of an easement is determined by the value of those rights to the land owner. If the easement will not significantly impair the owner's contemplated usage or sale of the land, the cost should be low; but, if it does, the cost will be higher.

There are two basic classes of easements - positive and negative. In positive easements, the right to do something with the property (e.g., build a road, install power line, or create high levels of noise over the of the property by its owner for certain activities is acquired. These easements may include the owner's rights to erect billboards, cut timber, build above certain elevation, or perhaps use the land for any noise-sensitive use.

For noise compatibility issues, both the positive easement to make noise over the land and the negative easement to prevent the creation of an unprotected noise-sensitive use on the property may need to be acquired to ensure adequate control. The easement should give its owner the right to make noise over the property. It should also include purchase of all the property owner's rights to establish or maintain an unprotected noise-sensitive use on the property. In the case of an existing unprotected noise-sensitive use, the cost of the easement could include the cost of either soundproofing or removing the noise-sensitive use from the property. A specific list of noise-sensitive uses, based on the criteria used for the compatibility study, should be specified as sound attenuation or other protection sufficient to place the noise-sensitive uses within the sound environment specified by the criteria.

E.1.2.2 OBTAINING EASEMENTS. Easements can be obtained in several ways, including purchase, condemnation, and dedication. For each easement acquired, it is wise to consider including a legal description of the noise that may be created over the property and classes of uses that may be established or maintained with and without soundproofing.

Purchase. Easements can be purchased through negotiation with the price based on the value to the owner of the rights surrendered. Timing can have a significant effect on the price paid; once the subject land has

come into the arena of speculation, prices tend to rise quickly. Under certain circumstances, Federal assistance may be available for such purchases.

Condemnation. Easements, as well as full rights to property, can also be obtained by condemnation. The cost, while still likely to be less than outright acquisition (fee simple), is likely to be significantly higher than similar rights obtained through negotiation. Also, the cost of any ill will generated by a condemnation action, while difficult to measure, can be significant.

Dedication. Dedication is another way to obtain easements. Two common types of dedication - subdivision and voluntary - are discussed briefly below.

Subdivision. Subdivision regulations governing the development of land for industrial or other purposes can include provision for dedicating private land or easements on private land for public purposes. When easements for airport-environs compatibility are considered necessary and are determined to be compatible with the intended land use, the need for such easements should be a required consideration in the review and approval of subdivision dedications.

Voluntary. Land owners in un-zoned areas may sometimes be persuaded to dedicate easements voluntarily for compatibility over their undeveloped land if assured of a fixed location for noise-impact areas. Thus, when the land is eventually zoned, the easement will help assure the owner of obtaining a zoning classification compatible with the noise. This arrangement may permit a lower tax rate during the interim years and may, coincidentally, generate a higher ultimate price for the land.

E.1.2.3 POSITIVE FEATURES OF EASEMENTS. Easement purchases are very straightforward transactions and are almost always less expensive than fee-simple purchases. They allow the installation to retain control over adjacent land without the burden of actual ownership. They are also usable in cases for which development already surrounds the installation.

E.1.2.4 NEGATIVE FEATURES OF EASEMENTS. There may be difficulty in obtaining the necessary easements, particularly when many land owners are involved, because their cooperation is required. Unless otherwise specified, the rights are not automatically transferred upon a resale of the land, so further negotiations may be required.

E.1.3 TRANSFER OF DEVELOPMENT RIGHTS (TDR).

TDR involves separate ownership and use of various "rights" associated with a parcel of real estate. Under the TDR concept, some of the property's developmental rights are transferred to a remote location where they may be used to intensify allowable development. With TDR, for example, lands within an installation's noise-impacted area could be kept in open space or agricultural areas and their developmental rights for residential uses transferred to locations outside the area. Landowners could be compensated for the transferred rights by their sale at the new locations or the rights could be purchased by the Army. Depending on market conditions and/or legal requirements, the Army could either hold or resell the rights. The TDR approach must be fully coordinated with the community's planning and zoning office. It may be necessary for the zoning ordinance to be amended so that it permits TDR's. Also, transfers usually must be contained within single zoning jurisdictions.

E.1.3.1 POSITIVE FEATURES OF TDRs. The program would be inexpensive or cost-free to the installation since the local government would administer it. The program could also stimulate growth and development of the property to which developmental rights were being transferred.

E.1.3.2 NEGATIVE FEATURES OF TDRs. One potential problem is record keeping. Because of the complexity of the transaction, it is often difficult to keep track of the principals and the exact number of rights that are sold and bought.

E.1.4 LAND PURCHASE.

Fee-simple purchase of noise-impacted land is the most positive form of land use control. It is also usually the most expensive. However, when combined with either resale for compatible uses or retention and use for a compatible public purpose, the net cost may be reduced greatly. As a preventive measure, purchase should usually be limited to critical locations or to cases for which other solutions would not work. Acquisition can be through negotiation with the property owner, by deed or gift, or through condemnation.

E.1.4.1 POSITIVE FEATURES OF LAND PURCHASE. An obvious positive feature of this method is that it allows the installation to gain complete control over the use of surrounding land. Ownership also allows eventual sale of property. This installation program reduces initial expenditures by allowing the property to be acquired over time.

E.1.4.2 NEGATIVE FEATURES OF LAND PURCHASE. The biggest problem with this method is the initial cost of acquiring the land. This initial outlay may prove too expensive to justify the acquisition. In addition, the cost of maintaining the property may prove too expensive in the future. Development on the property still could be prevented by restrictive or sales agreements.

E.1.5 BUILDING CODES.

A building code prescribes the basic requirements that regulate construction of structures. The building code is adopted by the local governing body to protect the health, safety, and general welfare of the occupants of these structures. The code establishes a set of requirements covering matters such as fire protection, building materials, lights, ventilation, exits, plumbing, and others. Although building codes are not a technique to actually prevent development, they can restrict it, especially near Army installations. A code can require that walls, partitions, and floor-ceiling construction have minimum sound transmission capabilities. The code can specify a certain sound transmission class (STC) that must be obtained. Specific construction techniques and materials can be stated in the code. Also, the code should require that certain noise levels are maintained after the structure is complete.

E.1.5.1 POSITIVE FEATURE OF BUILDING CODES. The positive feature of the building code is that it promotes construction and development of structures that contain noise-proofing features.

E.1.5.2 NEGATIVE FEATURE OF BUILDING CODE. The negative feature of building codes is that they do not prevent or restrict any type of land use around installations.

E.1.6 SUBDIVISION REGULATION.

Subdivision regulations are a means by which local government can ensure that proper lot layout, design, and improvements are included in new residential developments. These regulations specifically set guidelines that developers must follow when constructing their subdivisions; examples are minimum requirements for road widths, lot arrangements, allocation of facilities, the relationship of the subdivision to the surrounding area, and the dedication of property. Subdivision regulations are used to ensure that the health and habitability of each new residential development are maintained.

All local government subdivision regulations require some type of dedication of

open space to the public. This provision could be structured such that the space is located nearest the Army installation. Noise barriers might also be erected along these buffer areas. Also, larger buffer areas could be required for subdivisions closer to the noise source.

E.1.6.1 POSITIVE FEATURES OF SUBDIVISION REGULATIONS. Subdivision regulations can be used effectively diminish noise levels in a residential area. This control can be achieved by carefully locating open spaces among units in the subdivision.

E.1.6.2 NEGATIVE FEATURES OF SUBDIVISION REGULATIONS. Subdivision regulations alone will not prevent development around or near an installation. They are only a way to diminish the impact of noise emanating from the installation. Buffers placed in the subdivision may not be adequate to reduce the noise levels, providing only partial noise reduction. Administrative responsibility for subdivision regulations would then increase because of the additional requirements for noise attenuation. Thus, the cost to both the local government and the homeowner would increase.

E.1.7 HEALTH CODES.

The health code in a given community sets up the requirements that protect residents from adverse elements that may endanger them. These elements include disease, poor sanitary facilities, and inadequate or unsafe water supplies. Requirements in the code encompass all types of land uses. Similar to the building code, the health code does not actually prevent development around Army installations. The codes, however, can protect people from the noise impact of a nearby installation. At standard can be built into the code that would apply to noise-sensitive uses such as homes. The developer would be required to prohibit excessive noise levels in the development or consider another use that is not noise-sensitive.

E.1.7.1 POSITIVE FEATURES OF HEALTH CODES. The health code could be used in areas where zoning either is not used or is not an option. In most cases, the health code would be too strict to allow residential uses near installations, thus requiring some other, more compatible land use such as a manufacturing plant.

E.1.7.2 NEGATIVE FEATURES OF HEALTH CODES. The health code, depending on its complexity, is often difficult to administer. Also, field

checks have to be done to ensure compliance. The paperwork needed to administer the program is substantial. In addition, the time-consuming paperwork and field checks slow development.

E.1.8 DISCLOSURE OF NOISE LEVELS.

Noise levels in the community can be measured and recorded. By making these levels public information, incompatible uses around Army installations might be prevented. Noise levels can be disclosed in several ways. One method is by an ordinance or an amendment to an existing ordinance, which could be passed by the local governing body, requiring disclosure. Another method would be to implement a voluntary program among realtors in the community, who would inform the potential purchaser of any unacceptable noise levels. There are several ways in which such a program can be applied at the local level. First, a statement of noise levels could be included in the deed so that the purchaser of the property knows about them. Second, real estate or leasing agents could be required to inform prospective purchasers or tenants about the potential noise problem. Also, the noise level for that area could be posted on any "for sale" or "for lease" sign placed on the property. Finally, noise contours could be published on all subdivision plots and possibly all municipal, land use, and zoning maps.

E.1.8.1 POSITIVE FEATURES OF DISCLOSING NOISE LEVELS. The program would make information available to the public that had not been previously, including new residents who are unfamiliar with the area. The public could then make more informed choices about locating their residences and businesses.

E.1.8.2 NEGATIVE FEATURES OF DISCLOSING NOISE LEVELS. Simply disclosing the noise level information does not mean that the information will be used. Programs will be required to educate the public and ensure that the public remains informed in the future. Moreover, this measure could become costly and time-consuming if noise contours were required to be placed on all municipal maps.

E.1.9 HUD/VA REGULATIONS.

Both the Department of Housing and Urban Development (HUD) and the Department of Veterans Affairs (VA) have regulations concerning noise levels in areas where they might help finance new construction. Both agencies follow the DOD guidelines concerning the ICUZ Program. Neither agency will make loans in areas identified as having unacceptable noise levels. These areas correspond to a ADNL of 75 or greater (noise zone III). Only when the ADNL is less than 65 is a site totally acceptable. This control method has potential application to all DOD

installations.

E.1.9.1 POSITIVE FEATURES OF HUD/VA REGULATIONS. The program is similar to the development loan restriction except that public money is involved. Development, mostly residential, would be prohibited near an Army installation where noise levels are unacceptable.

E.1.9.2 NEGATIVE FEATURES OF HUD/VA REGULATIONS. These provisions do nothing for existing developments. Also, there is no current provision to prevent loans on the resale and subsequent purchase of existing structures. This measure is primarily limited to one type of land use - residential.

E.1.10 LAND BANKING.

The term "land banking" is defined as a system in which a government acquires a substantial fraction of land in a region available for future development for the purpose of implementing a public land use policy. Land banking prohibits the land being acquired from becoming committed to a specific use at the time of acquisition; in addition, the land must be large enough to have a substantial effect on urban growth patterns. Land banking differs from permanent acquisition in that it places the land in a temporary holding status to be turned over for development at a future date. Land banking can be used when development of a future installation is known. For example, land in excess of that required for the installation can be purchased and held for future use.

E.1.10.1 POSITIVE FEATURES OF LAND BANKING. The two primary arguments in favor of land banking are that it will have an anti-inflationary effect on land prices, thus preventing land speculation, and it will permit more rational patterns of development rather than urban sprawl.

E.1.10.2 NEGATIVE FEATURES OF LAND BANKING. Positive aspects of land banking are disputed on the basis that if there is an orderly development of land, there will be no land that is "wasted". Therefore, the functional use of each parcel of land will increase, thus raising the price of that parcel. Another factor to consider is that the program may become politically manipulated. Government officials in charge of the program could show favoritism both when lands are acquired and opened for sale on the market. In addition, an expenditure may be too large to even begin a program of land banking. Proponents claim, however, that the money can be recovered once the site is developed.

E.1.11 SPECIAL TAX TREATMENT.

Special or preferential tax assessment of land by a local government allows an owner of a piece of property to pay lower or no property tax. By taxing land around Army installations differently, open space can be maintained. There are three primary methods of using taxes to keep space open. First, tax exemption of open property could be encouraged. Second, preferential assessment of land would allow agricultural or open land to be taxed at a substantially lower rate. Third, tax deferral allows the owner of open property to forego property tax payments until a non-open space use is developed. Before such use is approved, however, all tax deferrals would have to be paid.

The States of Maryland and Pennsylvania have used preferential assessment in efforts to preserve open space; Virginia pioneered the tax deferral scheme. Both of these programs should be studied to determine their applicability to specific installations.

E.1.11.1 POSITIVE FEATURES OF SPECIAL TAX TREATMENT.

These methods are, again, a way of preventing development at no cost to the Army. The preservation of existing uses, especially agriculture, is promoted as well. Property that abuts the open space will become more valuable through the amenity that open space provides. The added value translates into increased tax revenue for the local government.

Because the open space is adjacent to an Army installation, the value of the amenity is somewhat diminished, however. Even if the value of the land stays constant, the tax program has worked.

E.1.11.2 NEGATIVE FEATURE OF SPECIAL TAX TREATMENT.

The cost of the program must be absorbed by the local government, which may refuse to implement it for this reason.

E.1.12 CAPITAL IMPROVEMENTS PROGRAM (CIP).

Capital improvements programming is the multi-year scheduling of physical upgrades to public property. A capital improvements program (CIP) is a planning tool used by local jurisdictions to phase the installation of needed public facilities (e.g., water and sewer, roads, schools) on a priority basis. A CIP usually projects needs three to six years into the future. It specifies what public improvements

will be constructed. Scheduling is based on studies of fiscal resources available and improvements needed. Many communities are starting growth management systems, of which a CIP is an important component. The CIP identifies the methods by which improvements will be financed and the source of the funds. Usually, development occurs where capital improvements are located. Extension of municipal services into an area makes that area more attractive to developers than sites without the improvements (i.e., the developer saves both time and money). Local governments should avoid extending capital improvements into high-noise areas to avoid the possibility of incompatible uses.

E.1.12.1 POSITIVE FEATURES OF CIP. There are many benefits to an effective CIP. For example, the CIP can: ensure that plans for community facilities are completed; effectively schedule public improvements that require more than one year to construct; avoid improvement mismanagement; and lead to effective growth management, among other features. CIP can and should be coordinated with local zoning ordinances to provide for growth management.

E.1.12.2 NEGATIVE FEATURES OF CIP. Capital improvements are limited to expenditures for physical facilities with relatively long-term usefulness and permanence. Often, misuse of a CIP can lead to haphazard or unwanted development.

E.1.13 DEVELOPMENT LOAN RESTRICTIONS.

To fund their projects, developers often need to borrow money from lending institutions. If their funds cannot be obtained, development will not occur. Restricting or prohibiting mortgage and/or other loans for certain land uses is thus a way to control development. For example, state and local governments could designate areas around Army installations for which loans to developers are prohibited. The designated areas would coincide with certain noise contours that would have already been determined. The local government would then prohibit banks and other lenders from making development funds available for those areas.

E.1.13.1 POSITIVE FEATURE OF DEVELOPMENT LOAN RESTRICTIONS. The attractive feature of this program is that it costs nothing for the local government to implement and still prevents development effectively.

E.1.13.2 NEGATIVE FEATURES OF DEVELOPMENT LOAN

RESTRICTIONS. The program usually cannot be implemented immediately because of possible court litigation. It is likely that lending institutions will sue the local government for not allowing them to use their money as they see fit, i.e., making loans to developers.

E.1.14 PUBLIC/PRIVATE LEASEBACK.

Leaseback is a financial arrangement in which the land is acquired and controlled, but not necessarily occupied, by the owner. This method can be used by both the public and private sectors. The leaseback arrangement in the private sector requires two simultaneous steps. First, an investor purchases real estate owned and used by a business firm or government. Second, the property is leased back to the firm or government by private persons for specific uses in accordance with the approved plan for the area. Customarily, the terms of the lease ranges from 20 to 40 years.

E.1.14.1 POSITIVE FEATURES OF PUBLIC/PRIVATE LEASEBACK.

Leaseback offers a way for public agencies to acquire land, yet provide for the continued use of the land by others. Public agencies can thus limit the land use, while acquiring some income from the property. The leaseback method is popular in the private sector because it provides capital from outside sources and is a flexible form of financing.

E.1.14.2 NEGATIVE FEATURES OF PUBLIC/PRIVATE LEASEBACK.

Public agencies often have the usual landlord's management problems. The leaseback arrangement also keeps land off the tax roles when used by the public sector, which lowers income to the government. Problems arise in the private sector when there is no repurchase option and the value of the property appreciates. Without this option, the lessee will not share in any value increases.

E.1.15 SALES AGREEMENT.

An essential ingredient in transferring real estate into a valuable commodity is the written agreement. A contract is a legally binding document in which certain parties agree to do or refrain from doing some action. The sales agreement is a legal contract which can be enforced through the legal process by either of the parties if the other party does not willingly comply with contract terms.

A sales agreement is needed to establish the terms agreed upon by the seller and

buyer. The buyer usually accepts the terms in the purchase agreement. Final acceptance of the purchase or sales agreement may be conditional upon proof of a clear title, rezoning to fit the land use plans of the buyer, or adequate financing from lenders. The minimum requirements for a sales contract are the parties' agreement to conditions of the sale, a description of the property, and signatures of the agreeing parties. An installation, through sales agreements, can restrict the use of surrounding lands if they own or control them. Of course, the buyer must accept the terms of the sales agreement.

E.1.15.1 POSITIVE FEATURES OF SALES AGREEMENTS. After signing, the sales agreement is a legally binding contract. The buyer and/or seller can seek legal recourse through the courts if the contract is broken.

E.1.15.2 NEGATIVE FEATURES OF SALES AGREEMENTS. Unlike the restrictive covenant, the sales agreement pertains only to the prospective buyer. The agreement does not carry over to future sales of the property unless so stated in the contract. In addition, certain areas of agreements and contracts are subject to possible misrepresentation and fraud.

E.1.16 DEED/COVENANTS.

A deed is the document conveying ownership of land from one party to another. Restrictions (known as "covenants") can be added to become an integral part of the deed. Such covenants specify the uses which the new owner may make of the land. Deed restrictions apply in addition to any zoning laws. They may even supersede the zoning law by prohibiting a specified use that might otherwise be legal from a zoning standpoint. Restrictive covenants are known technically as "running with the land". That is, no matter how often the land is subsequently resold, these restrictions remain in effect. They are a part of the land. There is usually a time limit placed on covenants of 20 to 30 years, after which they are no longer in effect. In certain instances, restrictions that have become impractical can be legally removed by the landowner, if deemed justifiable by the courts. For deed restrictions to be an effective tool, the installation must first own or acquire the property surrounding the installation. In later reselling this property, agents can specify which uses will be permitted on the land. The government can thereby prevent residential (or otherwise incompatible) land uses for as long as the restrictions remain in effect. This method is particularly useful in controlling development on the property most vulnerable to installation noise.

E.1.16.1 POSITIVE FEATURES OF DEED/COVENANTS. This method is

attractive because the installation retains control over surrounding land uses without needing to continue ownership of the land, thus lessening the tax burden. Deed restrictions are legally enforceable, regardless of how many times the property is resold.

E.1.16.2 NEGATIVE FEATURES OF DEED/COVENANTS. Some minor problems are associated with this method. The amount of land originally purchased for an Army installation must exceed the amount actually needed. This situation may present an excessive financial burden. Also, placing land use restrictions in the deed might hinder attempts to sell the land later.

E.1.17 PURCHASE OF DEVELOPMENT RIGHTS.

A title to real property contains several rights, including that of development. By purchasing this one right, incompatible land uses near Army installations might be prevented. Purchase of development rights would resemble a fee-simple purchase in terms of actual transaction and necessary legal paperwork. The difference would be that only one right is purchased rather than all of them. The development right of any property is usually the most valuable and desirable. The cost of the right is equal to the difference between the value of that parcel at its highest and best use and its existing value. A program of purchasing development rights could be used when insufficient funds are available for fee-simple purchases of land. The program would work best where development rights of agricultural land are purchased; the land would remain productive and yet no incompatible use could be developed.

E.1.17.1 POSITIVE FEATURES OF PURCHASING DEVELOPMENT RIGHTS. By purchasing development rights, land uses adjoining Army installations can be kept compatible. The purchase of these rights on lands surrounding an Army installation would thus achieve the goal of preventing development of any kind. After all the purchases have been made, no more administrative work would be needed. If the program could be completed in a relatively short period of time, administrative and land acquisition costs could be reduced. Also, purchasing development rights is much less expensive, in most cases, than fee-simple purchase.

E.1.17.2 NEGATIVE FEATURES OF PURCHASING DEVELOPMENT RIGHTS. Such a program requires major expenditure of funds because of the amount of land that encompasses Army installations.

Unwilling sellers may present a problem as well. If the highest and best use of the land is a high density one (e.g., multifamily), the price of the development rights would not be much less than that of fee-simple ownership.

E.1.18 EMINENT DOMAIN.

Eminent domain is a police power that enables governments to condemn and subsequently acquire private property for a public use. The public purchase clause is important in eminent domain proceedings. This clause allows local governments to use eminent domain for a wide variety of acquisitions. Exercising eminent domain forces an owner to sell his/her property for just compensation, regardless of the owner's desires. The sale price is determined by independent appraisals (usually three). If an agreement cannot be reached, the courts will determine the compensation price. Eminent domain can be used to create open space in a municipality. It is usually implemented as a last resort when property cannot be acquired or controlled by other methods. Property around an installation would be condemned and subsequently purchased. By paying for the property, the Army would receive clear title to it and thus control all rights.

E.1.18.1 POSITIVE FEATURES OF EMINENT DOMAIN. Like other acquisition methods, eminent domain allows the government to own full rights to the property. Eminent domain powers can be delegated or legislated to units other than city or county governments, such as park districts.

E.1.18.2 NEGATIVE FEATURES OF EMINENT DOMAIN. Eminent domain requires an expenditure of money to control the property. Also, eminent domain proceedings often result in litigation. If so, acquisition of the property may take years, if it occurs at all. Furthermore, eminent domain can be used to obtain only that land which is necessary.

E.1.19 PURCHASE OPTION.

An option is an agreement between the buyer and seller of a piece of property. In the agreement, the seller will hold the property for a specified time. In turn, the buyer agrees to pay a sum of money as consideration for the offer. At the time the option is granted, no real property ownership rights pass. Instead, the buyer is purchasing the right to buy at a fixed price within a specified period of time. The seller retains the money paid regardless of whether the option is exercised.

Option costs vary, but usually include the property taxes and a standard interest charge. The option can be used when funds cannot be acquired to purchase the property outright.

During the period of the option, funds presumably can be obtained to make the purchase. This period can also be used to examine rezoning possibilities or other actions that would affect ownership of the property.

E.1.19.1 POSITIVE FEATURES OF PURCHASE OPTION. As mentioned above, an option allows the buyer time to locate and secure funds necessary to make the final purchase. Also, the option prevents others from developing the property in a way unacceptable to the installation.

E.1.19.2 NEGATIVE FEATURES OF PURCHASE OPTION. This technique requires expenditure of funds to purchase the option. Even more funds must be appropriated if the option is set up to be renewed continuously.